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ABSTRACT

Focusing on the issue of feeding infants, this journal covers a wide range of information, research, and issues related to breast-feeding and its alternatives for feeding infants in both developing and industrialized countries. The journal is divided into the following sections: (1) "The Epidemiology of Breast-feeding: Frequency and Duration," including discussions of the decline in breast-feeding, and types and indicators of feeding; (2) "Anatomy and Physiology of the Mammary Glands"; (3) "Lactation: Its Advantages and Consequences," including explanations of nutritional, anti-infective, and psychological advantages, and discussions of mothers' nutritional status and planned parenthood; (4) "Managing Breast-feeding," which explains the procedure for, possible difficulties with, and actions to promote breast-feeding; (5) "Artificial Feeding"; and (6) "Weaning and Diversification," which discusses the relationship between diet and child development, and foods that can supplement breast milk. Recommendations for additional reading are provided. Appendices include sample questions for use in surveys on breast-feeding indicators; a list of 10 prerequisites for successful breast-feeding; and a summary of the international code for infant feeding. (MM)

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CHILDREN IN THE TROPICS

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FEEDING BABIES : FROM BREAST MILK TO THE FAMILY DISH

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INTERNATIONAL CHILDREN'S CENTRE – PARIS

The International Children's Centre was created by the French government in 1949, on the initiative of Professor Robert Debre in particular, following negociations between France and the United Nations. Its purpose was to furnish those international and national agencies dealing specifically with child care with training facilities and educational and informational tools in the field of child health and development, viewing children within their family and surroundings.

ICC soon turned essentially toward Third World children and devoted its activities to the training and education of personnel with social, educational and administrative responsabilities as well as medical and paramedical workers. The desire for greater efficiency has led it to work increasingly with trainers and to concentrate its efforts on the methodological and educational aspects of mother and child care programmes.

ICC is also engaged in an attempt to further study — and — action on some aspects of the life and health of children and their family, so as to contribute to practical improvement, particularly in the fields of growth, nutrition, planned parenthood, the control of transmissible and nutritional diseases, preschool and school education, the needs of disabled and underprivileged children, etc.

Over this period of more than 30 years, a large amount of documents on children and adolescents, mostly from the developing countries, has been accumulated. This international documentation has been classified and sorted out, and has been computerized since 1983 : a bibliographic data base (BIRD : « Base d'Informations Robert Debré ») may be consulted anywhere in the world, through international communications networks. ICC also publishes periodicals, educational documents and specialized bibliographic bulletins.

As for its legal status, the International Children's Centre is a foundation under french law of recognized public utility, administered by an executive board with broad international membership.

CHILDREN
IN THE TROPICS

REVIEW OF THE INTERNATIONAL CHILDREN'S CENTRE

FEEDING BABIES : FROM BREAST MILK TO THE FAMILY DISH

ANNE-MARIE MASSE-RAIMBAULT

1992 - N° 202-203

FEEDING BABIES : FROM BREAST MILK TO THE FAMILY DISH

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Our sincere thanks to Prof. Henri Dupin, whose knowledgeable support was invaluable in the conception of this issue, and to Dr. Michel Chauliac, for his thorough critical reading.

Children in the Tropics has been published in French and English for the last 30 years. A new, Spanish edition is in the making, and will be issued in the course of 1993.

All those readers for whom this Spanish edition would be a more appropriate tool are requested to contact us as soon as possible.

PREFACE

Thirty years have already gone by since Jean Sénécal, then professor of paediatrics at the University of Dakar, conceived the project of a periodical aimed at helping health and education professionals working in developing countries, and more specifically in Africa, to update their knowledge about children's health and development. Prof. Robert Debre, founder of the International Children's Centre, approved this initiative and encouraged the creation of Children in the Tropics.

Over the past three decades, this journal has not only managed to come out regularly, but it has modified its conception, enlarged its readership - with an English edition, first published in 1968 - and modernized its presentation.

While our journal has never lost sight of its initial objectives, it has adapted itself to scientific advances, the development of original concepts and strategies, and the emerging of new policy orientations. The very notion of health has changed, to become more all-embracing, the role of the family in the well-being of mothers and children has become clearer, economic factors have come to the forefront, with the international crisis. Last, there has been a need to seek appropriate structures and strategies in response to the present-day problems of rampant urban development.

This comprehensive approach increasingly requires the participation of specialists from other fields, as new and varied as the social sciences (anthropology, psychology and economy), the food sciences and city planning. This has brought us to diversify our contributors, and recently, to broach unusual subjects such as the social approach to food and diet, rural agrobusiness, learning to read or adolescent health.

A special effort has been made to improve our understanding of the living conditions of families and communities, so as to respect their needs and desires, to support their initiatives and action, in a spirit of community self-organization and participation.

Technical updating, scientific information, exchanges of experience : these are the main options upheld by this educational tool. Children in the Tropics is presently circulated in 112 developing countries and 36 industrialized countries - 150 in all - with 8,000 copies in French and 4,000 for the English version. After years of waiting and hoping, a Spanish edition will at last see the light in 1993.

It is our wish, at present, that readers will contribute accounts of their concrete, original, innovative experiences, to be included in the coming issues when appropriate to the subjects discussed, so as to create a meeting ground, rich in ideas and exchanges.

Prof. Henri Dupin

Dr. Anne-Marie Masse-Raimbault

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THE EPIDEMIOLOGY OF BREAST-FEEDING : FREQUENCY AND DURATION

"Breast-feeding is an extremely ancient process, dating back more than two hundred million years, and which existed long before placental gestation in oviparous mammals. The human species appeared on Earth about five hundred thousand years ago. Only in the past 11,000 years has it used the milk of domesticated animals, and artificial feeding, in the strict sense of the term, is only 70 years old. This means that the "baby bottle period" is quite recent, and only occupies an extremely short interval within human history. The consequences of this rapid changeover are still not well known".

To this picture, painted by Jelliffe at the first international conference on breast-feeding (Abidjan, Ivory Coast, 1972), we should add the fact that however ancient this practice, and despite the wealth of research on it, our knowledge of breast-feeding is still incomplete but nonetheless sufficient to convince us of its superiority.

THE EPIDEMIOLOGICAL SITUATION

In several industrialized countries, a considerable decline in breast-feeding seems to have been followed by a strong upturn, caused by a number of factors including families' greater awareness of the benefits of breast milk, promotion of this type of feeding, better training of health workers, support for mothers when they return home and also, a certain ecology-mindedness. This renewed favour of breast-feeding began in the educated, affluent strata of society, and affected prevalence - more women breast-feed their baby - as well as duration.

Conversely, in many developing countries, the situation is deteriorating despite efforts at information, education and training, all aimed at furthering breast-feeding both in its own right and as a complementary planned parenthood method.

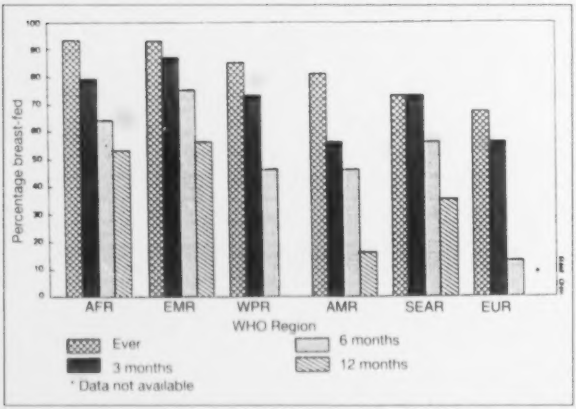

Figure 1 : Estimated prevalence of breast-feeding, by age and WHO region, in urban areas (1).

AFR : Africa ; EMR : Eastern Mediterranean Region ; WPR : Western Pacific Region ; AMR : Region of the Americas ; SEAR : South-East Asia Region ; EUR : Europe.

(1) Wkly Epidem. Rec. : n° 43, 27 October 1989.

Figures 1 and 2 show the prevalence of breast-feeding in various parts of the world (countries are grouped according to the WHO geographic classification system) : they show that rural populations tend to resort more to breast-feeding than urban groups.

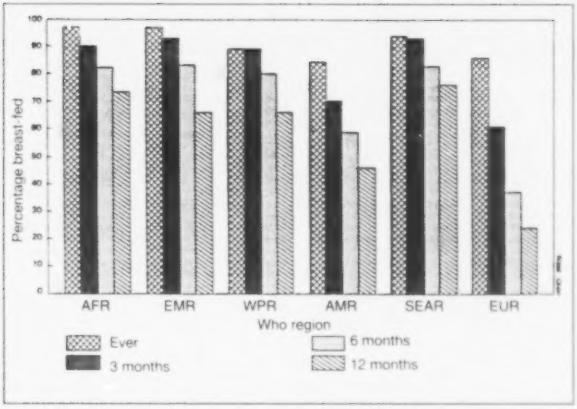

Figure 2 : Estimated prevalence of breast-feeding, by age and WHO region, in rural areas (1).

AFR : Africa ; EMR : Eastern Mediterranean Region ; WPR : Western Pacific Region ; AMR : Region of the Americas ; SEAR : South-East Asia Region ; EUR : Europe.

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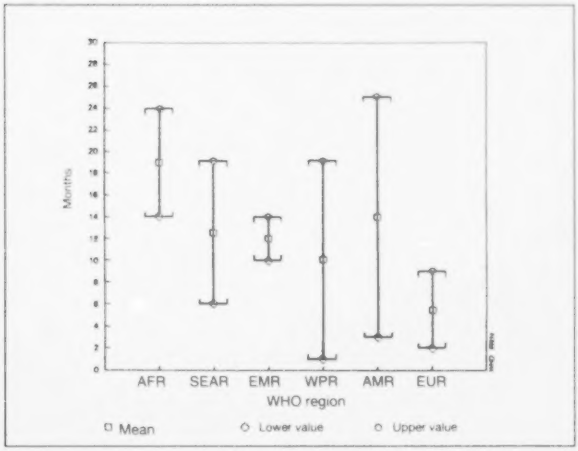

Figure 3 : Estimated duration of breast-feeding, by WHO Region (1).

AFR : Africa ; SEAR : South-East Asia Region ; EMR : Eastern Mediterranean Region ; WPR : Western Pacific Region ; AMR : Region of the Americas ; EUR : Europe.

(1) Wkly Epidem. Rec. : n° 42. 20 October 1989.

These estimations should be interpreted with caution, since they depend both on the percentage of families living in urban or rural areas, and secondly, they vary within a given region or country, depending on socioeconomic status. For example : in Latin America, the population is overwhelmingly urban, whereas it is still quite rural in Africa. Further, it should be remembered that "the Americas" includes the USA and the countries of South and Central America.

The prevalence of breast-feeding beyond age 3 months is higher in Africa and south-east Asia and lower in Europe and the Americas (figure 3). In the Americas, close to one child out of two is still breast-fed at 12 months in rural areas, whereas only 16 % of city children still suckle at the same age. In Europe, it is the affluent, educated mothers who prolong breast-feeding, whereas the opposite is true in developing countries, where it is more frequent among rural mothers. In Nigeria, for instance, the percentage of entirely breast-fed infants at 1 month ranges from 68 % in a village to less than 1 % in the urban elite of the city of Ibadan.

To determine the actual breast-feeding situation, it is important to distinguish between urban and rural areas, but also between the different social strata within a given geographic location. In the USA, for instance, the white population has been more rapidly affected by the decline in breast-feeding than the Spanish-American, Asian-American and black populations. In France, there is clear

evidence that foreign mothers (from North Africa, Spain and Portugal) continue breast-feeding longer than French mothers.

CAUSES OF THE DECLINE IN BREAST-FEEDING

The underlying reasons for this foresaking of breast-feeding seem to be the outcome of a number of closely interrelated factors acting concomitantly, at different points in time and with variable intensity, on each of the socioeconomic strata of a population.

Urban development

Modifications in the family and social structure are quite instrumental : urban development often breaks extended families down into nuclear units, thus reducing psychological support, help and the example provided by elders. This urban spread also corresponds to a new form of employment for mothers, who often work far from their home.

Working mothers

Officials have attempted to minimize the effects of this factor by enacting legislation prescribing maternity leaves and indemnities equal to at least 60 % of the previous wages. In Burkina Faso, for instance, maternity leaves last 14 weeks. The indemnity corresponds to 2/3 of the mother's previous wages, and the mother is entitled to take an hour a day at her workplace to breast-feed her baby during 15 minute-pauses. France has 16-week maternity leaves, at 90 % of the mother's previous pay. In developing countries, however, this legislation is not necessarily enforced : furthermore, it only affects a minute fraction of women, since many mothers work at odd jobs in the informal sector. There are also women in rural areas whose fields are located at a distance from their home. In some countries where legislation exists, mothers themselves often get around it, taking advantage of this free time to do other, often more strenuous work, so as to improve the family income.

Other changes in the social structures include modifications in the family unit. In some countries, including much of Central and South America, the percentage of women heads of household is very high. This also has repercussions on the drop in breast-feeding.

Nice figure

The influence of aesthetic motivations should not be neglected, since fashion imposes a certain type of silhouette, which is not necessarily compatible with breast-feeding : women tend to believe - erroneously - that breast-feeding enlarges and deforms the breasts. Psychologically speaking, some women express rejection, or even disgust, at the idea of suckling. Here too, a change in mentality is evident. The sexual, erotic symbolism of breasts prevails over their role as nurturing glands.

Advertising

Certain factors are attributable to the agrobusiness world, with the development of infant formula foods, along with aggressive, extremely well orchestrated advertising. Industrial advances have been supported by the privileged classes, who adopted this type of food for their children, and were then imitated by the underprivileged. If baby bottles and infant formulas are good for the growth of babies in rich, well-educated families, why not use them too?

It is true that women in different parts of the world have lived through a number of phases between generalized breast-feeding and the present-day situation. In some European countries, for example, there was breast-feeding using wet-nurses, followed by the use of cow's milk, homemade porridges, and last, the development of breast milk substitutes, and their increasingly early introduction in the child's diet.

Health workers' training

While these transformations took place - at varying paces depending on the country and the social class - the training given to health workers did not enable them to gain awareness of the problem and to be capable of action. Their knowledge of the biological, nutritional, social and educational aspects of breast-feeding were not solid enough, and when the scientific world became aware of this, it was already too late to prevent this evolution, or at least to reduce its most nefarious effects. The lack of any policy fostering breast-feeding and the organization of health services, especially in those maternity wards where mother and baby are separated after delivery, and the child is put to the breast only 24 or 48 hours after birth, and where neonates are given sweetened water or some other fluid during the first hours, were all contributive factors in the decline and eventual abandoning of this type of feeding.

Aside from a few research teams and paediatricians, who were forerunners in the battle for it, most people viewed breast-feeding simply as a traditional method, and its irreplaceable positive effects did not receive any publicity. The decline of breast-feeding was viewed as an inevictable consequence of modern life. Health officials tend to resign themselves too easily to the fact that mothers do not breast-feed, or claim not to have enough milk : it is hard to accurately determine the percentage of women who are physically unable to breast-feed, but the figure is very low. Contemporary life has not modified women's biological make-up to the point of inhibiting lactation and making them less capable of breast-feeding than earlier generations.

Present-day studies on breast-feeding should of course determine the number of women who do nurse, but above all, the duration of this type of feeding and the causes of the more or less early introduction of complementary foods.

TYPES OF FEEDING AND INDICATORS

It is important that health teams at the different administrative levels (district, province, country) monitor the evolution of breast-feeding practices, determine the variations in duration with social position, and achieve an understanding of the underlying causes of its decline or advance. If the types of feeding, the changes occurring and the impact of programmes for the promotion of breast-feeding are to be properly evaluated, uniform definitions and basic indicators must be used. In 1991, the World Health Organization proposed a series of indicators to be recorded during surveys of households (1). A different list - not yet established - should be used for studies done in health units.

(1) Indicators for assessing breast-feeding practices. WHO, Geneva, 1991.

SOME DEFINITIONS

Breast-feeding is said to be exclusive when the infant is fed only breast milk from his/her mother (or a wet nurse, or expressed milk), with no other liquids or solids, with the exception of drops or syrups consisting of vitamins, mineral supplements or medicines.

Breast-feeding is said to be predominant when the infant's predominant source of nourishment has been breast milk. However, the infant may also have received water or water-based drinks (sweetened, flavoured water, teas, infusions, etc.), fruit juices, oral rehydration solution (ORS), drop and syrup forms of vitamins, minerals and medicines, and ritual fluids (in limited quantities).

Exclusive and predominant breast-feeding, taken together, represent **full breast-feeding.** When the infant is given both breast milk and solid or semi-solid food, breast-feeding is said to be complementary. Children fed fluid (or semi-solid) food in a baby bottle are said to be bottle-fed, even if the bottle contains breast milk.

Table 1
Criteria for inclusion in infant feeding categories

Category of infant-feeding	Requires that the infant receive	Allows the infant to receive	Does not allow the infant to receive
Exclusive breast-feeding	Breast milk (including milk expressed from wet nurse)	Drops, syrups (vitamins, minerals, medicines)	Anything else
Predominant breast-feeding	Breast milk (including milk expressed or from wet nurse) as the predominant source of nourishment	Liquids (water and water-based drinks, fruit juice, ORS), ritual fluids and drops or syrups (vitamins, minerals, medicines)	Anything else (in particular non-human milk, food-based fluids)
Complementary feeding	Breast milk and solid or semi-solid foods	Any food or liquid including non-human milk	
Bottle-feeding	Any liquid or semi-solid food from a bottle with nipple/teat	Any food or liquid including non-human milk. Also allows breast milk by bottle	

Source : WHO/CDD/SER/91.14.

Once these definitions have been clarified, the type of diet toward which programmes should be oriented must be defined. Breast-feeding for all infants until age 4 to 6 months would be ideal. That is, at age 4 months, 100 % of children would be exclusively breast fed (with vitamin and mineral supplements if required for the child's health and growth). During a transitional 2-month period complementary foods should be given, to meet infants' nutritional requirements, so that at age 6 months 100 % of infants should be receiving complementary foods in addition to breast-feeding. Children should continue to be breast-fed until age one year at the least : that is, they should receive breast milk plus semi-solid or solid food. There is no reason not to continue breast-feeding even longer, especially when the complementary foods are inadequate, for financial reasons (cf. figure 4).

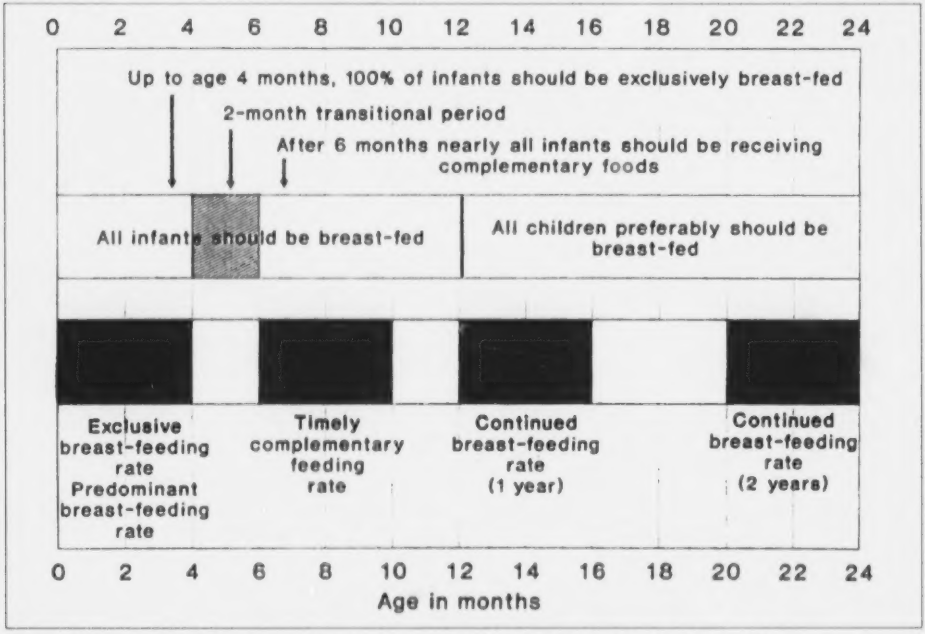
0 2 4 6 8 10 12 14 16 18 20 22 24
Up to age 4 months, 100% of infants should be exclusively breast-fed
2-month transitional period
After 6 months nearly all infants should be receiving complementary foods
All infants should be breast-fed
All children preferably should be breast-fed
Exclusive breast-feeding rate Predominant breast-feeding rate
Timely complementary feeding rate
Continued breast-feeding rate (1 year)
Continued breast-feeding rate (2 years)
0 2 4 6 8 10 12 14 16 18 20 22 24
Age in months

Figure 4 : Age groups for measuring indicators in relation to feeding recommendations (1).

(1) OMS/CDD/SER/91.14.

INDICATORS

In household surveys, families are questioned on the diet of their children under age 2 : the data requested is present diet, based on recall for the 24 hours previous to the survey. Retrospective surveys, calling for memory, are not used. All children born during a specific period - the past 24 months - and not only the last-born, are considered, and mothers are asked what they were fed during the past 24 hours (cf. appendix 1).

Exclusive breast-feeding rate

$$\frac{\text{Exclusively breast-fed infants} < 4 \text{ months (120 days) of age}}{\text{Infants} < 4 \text{ months of age}}$$

Predominant breast-feeding rate

$$\frac{\text{Predominantly breast-fed infants} < 4 \text{ months (120 days) of age}}{\text{Infants} < 4 \text{ months of age}}$$

Timely complementary feeding rate

$$\frac{\text{Infants 6 to 9 months (180 to 299 days) of age fed complementary foods in addition to breast milk}}{\text{Infants 6 to 9 months of age}}$$

Continued breast-feeding rate (1 year)

$$\frac{\text{Breast-fed children 12 to 15 months of age}}{\text{Children 12 to 15 months of age}}$$

Continued breast-feeding rate (2 years)

$$\frac{\text{Breast-fed children 20 to 23 months of age}}{\text{Children 20 to 23 months of age}}$$

Bottle-feeding rate

$$\frac{\text{Bottle-fed infants} < 12 \text{ months (366 days) of age}}{\text{Infants} < 12 \text{ months of age}}$$

Readers will have noticed that children aged 4 to 6, 9 to 12 and 15 to 20 months have been excluded here, since these are not the target ages. This decision was made in accordance with the objectives pursued and in order to avoid overburdening of investigators.

To determine the number of younger bottle-fed children (under age 6 months, for instance) for a programme aimed at controlling diarrhoeal disease, the same calculation may be performed.

ANATOMY AND PHYSIOLOGY OF THE MAMMARY GLANDS

In both the male and the female foetus, the development of the future mammary gland is initially marked (toward the 6th/7th week of gestation) by the thickening of the ectoderm (or skin), composed of 4 to 6 layers of cells, which gradually invade the mesenchyma. Toward the 15th week of gestation, they produce about twenty epithelial buds, which are the future mammary lobes. Vascularization then gradually develops, along with the alveolar system and the connective and adipous (fatty) tissue. No hormonal action is involved in these first embryological stages. The secretion of colostrum, known as witches' milk, occasionally seen in newborns (including in boys) is due to the action of the placental crossing of the mother's sexual hormones. This should not be a cause for concern.

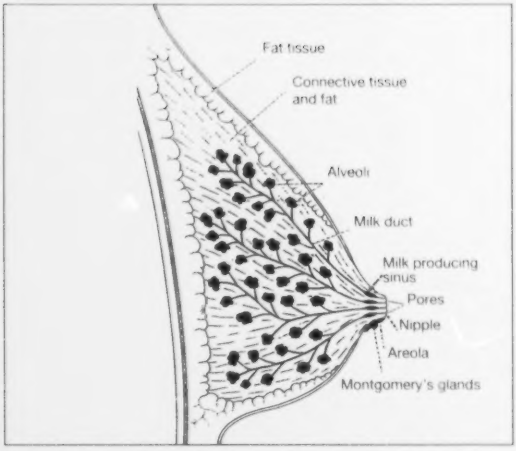

Figure 5 : Anatomy of the breast : longitudinal section.

At puberty, hormones (oestrogens and progesterone) are secreted, causing the development of the galactophorous (or milk) ducts, and the growth of the fat and connective tissue. The breasts, as well as the areolae, are enlarged, and their pigmentation reinforced. These changes occur during puberty, but other changes are connected with pregnancy. Each ovarian cycle induces modifications in the gland, linked with variations in the sexual hormones.

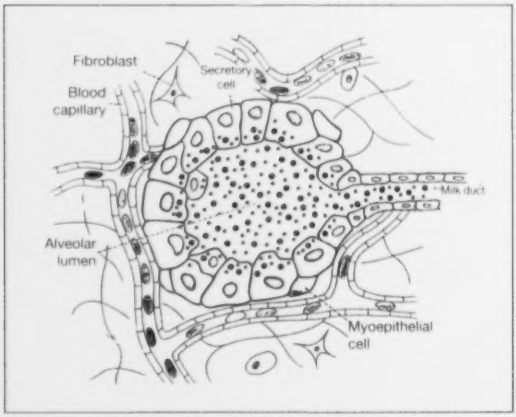

Figure 6 : Cross-section of an alveola in the mammary gland.

The breast is composed of 15 to 26 lobes, each made of a set of alveoli (cf. figure 5). This is the glandular tissue, surrounded by connective and fat tissue. Each alveola is made up of secretory cells, which will produce the different components of milk. The alveola is surrounded by blood vessels, which convey the ingredients required for the production of milk, and by smooth muscle cells, the contraction of which expels the milk toward the central cavity of the alveola, then toward the milk ducts (cf. figure 6).

Before reaching the nipple, these ducts open into lactiferous sinuses in which the milk collects. From these, extremely thin tubes go to the nipple, and to a dozen pores, which are open-ended.

There are not as many pores as ducts, since the latter may merge. This whole part is enrobed in varying amounts of fat and connective tissue, depending on the woman : this is what makes for different sized breasts. The size of a woman's breasts should not be confused with her ability to breast-feed.

The nipple is surrounded by the areola, on which small swellings (Montgomery's glands) may be seen : these secrete an odorous substance. The areola and the nipple are richly innervated (they contain many nerve filaments) and their sensitivity is enhanced during pregnancy. The stimulation of these nerve endings causes the nipple to become erect and triggers the production of oxytocin (the hypophyseal milk-ejecting hormone) and of prolactin (the hypophyseal milk-secretion hormone), through reflex hypophyseal mechanisms. During pregnancy, the nipple becomes enlarged and points forward. The more protuberant it is, the easier it will be for the infant to suckle. This explains why it is essential to examine the breasts of expectant mothers during antenatal visits or any preparation for breast-feeding, since certain types of nipple retraction may easily be corrected.

PHYSIOLOGY

The mammary gland achieves full development during gestation. This is particularly true of the secretory tissue, which is under hormonal control : the oestrogens spur the development of the milk ducts, and progesterone is active in the growth and multiplication of the alveoli, which complete their development and close up. Othe hormones, such as the lactogenic placental hormone (prolactin), the growth hormone and insulin, play a role in the multiplication of the secretory cells and their ramifications with the blood vessels. At the end of pregnancy, they produce the milk fats and proteins. Progesterone counteracts milk production, and its well-known action is used, in drug form, to stop milk secretion. It is important to note that the breasts may secrete minute quantities of milk as early as the 16th week of gestation.

Following birth, there is a period of inflow, triggered by the expulsion of the placenta, putting an end to the secretion of the placental hormones, and by the rapid drop in progesterone concentration. The high level of the latter had been a powerful brake until then, since it blocks the induction of lactation (by inhibiting lactose production and the secretion of prolactin) while fostering mammary growth.

The breasts first produce colostrum, followed by milk, the composition of which changes gradually to respond to the evolution of the baby's needs. Lactose production increases, and the amount of milk is augmented at the same time, since lactose is the most active ingredient, as far as osmosis is concerned.

Prolactin

When the infant sucks the nipple, the secretion of prolactin by the anterior hypophyseal lobe is stimulated. Prolactin is a milk-producing hormone, which initially triggers milk production ; it affects lactose build-up, through alpha-lactalbumin. It is also responsible for water and salt retention by the kidneys. Milk inflow is

regulated by the baby's sucking. Milk production, then, is produced by a reflex neuroendocrine process : it is a somatic mechanism. That is, the more the child sucks actively and frequently, the greater the secretion of milk.

Milk is produced by the secretory cells of the alveoli located at the base of the milk ducts. These mammary cells are a real processing factory. They act as a filter, since they receive the vitamins, water, certain ions and immunoglobulins directly from the blood vessels, but they also synthesize lactose, and construct certain fatty acids and amino acids. The upper part of the cell contains the ingredients of milk and secretes the finished product, whereas the lower part, with its nucleus and processing elements, reconstitutes the cell, which can then continue to secrete.

This biosynthesis and milk-secretion phenomenon is coupled with the ejection of the milk into the ducts and lactiferous sinuses, then out of the breast, because of the extreme tension within the alveoli.

Oxytocin

Milk excretion is commanded by a post-hypophyseal hormone, oxytocin, the secretion of which is stimulated by the child's sucking on the nipple. Oxytocin causes the muscle cells to contract, thus emptying the alveoli, dilating the milk ducts and pushing milk out. Oxytocin also causes contraction of the muscles of the uterus, thus helping it to return to normal and to stop bleeding.

In short, lactation is the product of five reflexes which take place simultaneously. First, three somatic reflexes in the infant : seeking out the breast by the mouth, sucking and swallowing. The burrowing reflex leads the child to seek the nipple actively, with an open mouth, so as to take a part of the breast. The sucking reflex involves a rhythmic movement of the jaws, forming a depression in the mouth, followed by a peristaltic movement of the tongue by which the milk is drawn in and sent to the oesophagus. There, a swallowing reflex which sends the milk down. Next, two reflexes occur in the mother : the milk secretion reflex induced by prolactin, and the milk-ejection reflex, with the participation of oxytocin.

The secretion reflex is somatic, so that an increase in the frequency and vigour of sucking leads to a more abundant milk production, whereas the ejection, or "let-down" reflex is psychosomatic, meaning that it is extremely sensitive to emotional and psychological disturbances. Anxiety, fatigue, emotions, pain and stress may inhibit it, whereas confidence in breast-feeding, belief in the importance of this type of feeding, a feeling of security and interest may improve it. The ejection reflex responds not only to tactile stimuli, but also to olfactive, auditive and visual ones. The sight, sound and smell of her child, as well as skin contact, are shared sensations which contribute to the development of close mother-child relations, and cause secretion to begin and to increase.

To begin breast-feeding and the shared learning of this type of feeding properly, mother and newborn must be allowed intimate contact during the very first instants following birth. The baby

should be put to the breast within an hour of birth, and above all, should not be given anything else, any other food, so that the physiological and behavioural process of breast-feeding may get under way.

Lactation becomes automatic within a few weeks : the blood concentration of hypophyseal hormones declines, and milk secretion is effective. Sucking and milk-taking stimulate its secretion and ejection, and regulate the amount of milk produced by each breast. Both breasts are equally affected by the hormones, but the amount of milk produced by each one depends on how much milk is taken by the child (cf. figure 7).

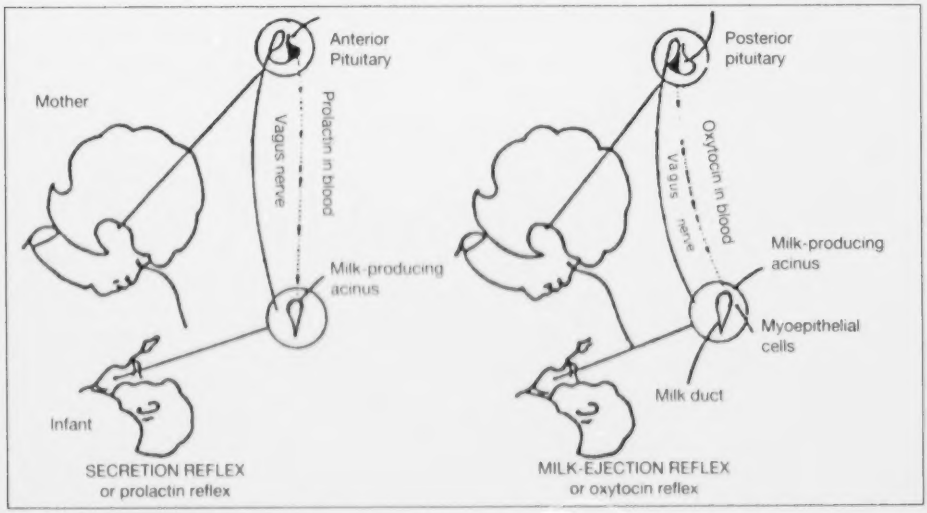

Figure 7 : The production of milk (1).

(1) According to JELLIFFE. Abidjan, 1972.

LACTATION : ITS ADVANTAGES AND CONSEQUENCES

ADVANTAGES FOR THE INFANT

NUTRITIONAL ADVANTAGES

Immediately after delivery, milk production is slight, and is composed of a sticky, yellowish fluid called colostrum, which gradually grows thicker and is replaced by a transitional milk between the 6/8th day and the 30/40th day after birth. The milk then becomes very thin, and enters the mature milk phase. All of these variations in its appearance correspond to changes in its chemical composition, which is constantly modified in response to the infant's needs.

The amount of colostrum produced varies considerably (10 to 100 ml a day, with a mean of 30 ml). Despite its small volume, it is extremely nourishing : it contains less lactose and fat than mature milk, but is richer in proteins and in certain minerals such as sodium. Its main function is anti-infectious, through the immunoglobulins and various other protective substances it contains, which coat the intestinal mucosa and prevent bacteria, viruses and parasites from adhering to it. These mechanisms are particularly appropriate to the nutritional and anti-infective needs of newborns, but also to their newly developing physiological possibilities, with respect both to enzymes (lactase, like the other enzymes, begins to be secreted) and to the kidneys (which are unable to handle large amounts of fluid). In normal newborns, any addition of water or food would disturb the adequation of these very precise systems.

Composition of breast milk

There has been much research and controversy around the composition of breast milk and comparisons with cow's milk and infant formulas. The composition of milk varies from one mother to another, from one breast to the other in a given woman, from one feed to another and even in the course of a feed. Furthermore, some differences occur as months go by. These variations explain why it is so difficult to interpret research findings, and develop manufactured formulas that come as close as possible to breast milk. Roughly speaking, then, the composition of breast milk is as follows.

Proteins

Proteins : the belief that cow's milk is preferable because it contains more proteins than breast milk is erroneous. The mean protein content of human milk is estimated at 1.15 gram per 100 millilitres of milk, while cow's milk contains 3.3 g/100 ml. Substantial differences from one mother to another have been documented : they may explain the variations in the amounts of milk ingested by infants with satisfactory development and fed on request.

There are two types of milk protein, one micellar, the other soluble. The milk micelles are round particles containing casein and mineral ions (Ca, Mg, phosphate). The casein is in a stable suspension, and this is what makes the milk look white. The soluble proteins, or lactoserum, are dissolved. They include alpha-lactalbumin, quanti-

tatively predominant, and which is a factor in the enzymatic system involved in lactose synthesis. Other proteins also present are : lactoferrin, lysozyme, immunoglobulins, etc. These are anti-infective proteins which resist proteolysis and are of negligeable nutritive value, since they are not digested. The proteins in human breast milk and in cow's milk are completely different, despite some resemblances. Human milk contains more cystine, essential for the foetus and for prematures, and less methionine than cow's milk. It is rich in taurine, indispensable for infants but which they, unlike adults, are unable to synthesize.

Fats

Fats are the part of human milk that is most influenced by the mother's dietary intake on the days preceding assay of her milk, and which vary most from one mother to another. If the mother is extremely malnourished, she draws on her reserves, and the composition of the fats in her milk is similar to that of her own fatty tissue. This finding has been documented from the colostrum phase, in which the fat content is about 2.0 g/100 ml, to the mature milk phase, in which it is around 4.5 g/100 ml. Fluctuations occur in the course of the day (with the highest concentrations in late morning and early afternoon), but also in the course of a feed (the fat content rises at the end, as if to regulate appetite).

Fats provide most of the infant's energy intake (about 35 to 50 %), as opposed to the foetal period, when glucose was the main source of energy. This high fat intake may seem surprising, since the infant's pancreas and liver are still immature. Partial compensation for this immaturity is afforded by the lingual and gastric lipases, but also by a lipase present in milk, and which is active in the digestion of fats. The human species is practically unique, with gorillas, in providing its young simultaneously with a nutrient and its enzyme. The breast milk fats are composed of saturated fatty acids (about 42 %) and unsaturated fatty acids (about 57 %). The latter include arachidonic and linoleic acids, which are especially important for the development of the brain and for myelinization, but which also play a role in the synthesis of the prostaglandins.

It should be noted that while the brain grows enormously during intrauterine life, it continues to have a 2-gramme a day increment during the first two months of life. The 8-centimetre increase in head circumference during the first four months is a major one.

Carbohydrates

The main carbohydrate is lactose, a sugar composed of one molecule of glucose and one of galactose. Aside from its presence in milk, it is rarely encountered in living beings. It is much less sweet than ordinary sugar or saccharose. Colostrum contains about 4 g/100 ml of lactose, and mature milk 7 g/100 ml, on the average. Lactose covers approximately 40 % of the infant's energy requirements, thanks to its glucose content. It plays an essential role in digestion : lactase breaks it down into galactose, which is essential to the development of the central nervous system, and glucose. Lactase, an enzyme located on the enterocytes (cells in the small intestine) apparently does not always function in European adults, who may develop varying degrees of intolerance to lactose, resul-

ting in disorders including intestinal problems. Lactose is instrumental in the colonization of the intestine by Lactobacillus bifidus, which are bacteria that are active in fermentation, thus acidifying the digestive track and preventing the growth of bacteria, yeasts and parasites. Growth of the lactobacillus is improved by the bifidus factor, a nitric carbohydrate contained in breast milk. Any other food given within days of birth disturbs this protective mechanism, then. Furthermore, lactose facilitates the uptake of iron and calcium.

Table 2
Comparison between breast milk during the 1st month of lactation and unprocessed cow's milk

Constituants	Breast milk Grammes per litre*	Cow's milk Grammes per litre*
PROTEINS :	11	33
- Casein	4	28
- Soluble proteins	7	5
Lactalbumin	3.5	1.5 to 1.8
Beta-lactoglobulin	0	3,7
Lactotransferrin	1 to 2	0.2 to 0.5
Immunoglobulin	1 to 2	0.5
Lysozyme	0.5	Traces
NON-PROTEIN NITROGENOUS SUBSTANCES	0.32	0.32
LIPIDS :	35	35
- Linoleic acid	3.5	1
CARBOHYDRATES	70	50
- Lactose	62	50
- Nitrogenous oligosaccharides	8	0
MINERALS :	2	8
- Ca	0.33	1
- P	0.15	1
- Fe	0.4 to 1.5 mg	0.3 to 0.5 mg
VITAMINS		
- C	60 mg	20 mg
- D	50 UI	25 UI
Energy	640-720 kcal 2 670-3 000 kJ	650 kcal 2 717 kJ

** Unless otherwise specified.*
Source : Vermeil G, Dupin H et al. Alimentation des nourrissons et des jeunes enfants. In : Alimentation et nutrition humaines. Paris : ESF, 1992; 1 533 p.

Minerals

Most of the minerals present in breast milk are not dependent on the mother's diet. This is particularly true of potassium, calcium, iron, phosphorus, fluoride, zinc and magnesium. Breast milk is adapted to the infant's nutritional needs, but also to its metabolic and excretory capabilities. It contains less sodium than cow's milk, for instance, and does not put any unnecessary strain on the

infant's kidneys, then. The calcium/phosphorus ratio is high, so that the uptake of calcium is better than with cow's milk. Indeed, the high phosphorus content of cow's milk causes this mineral to be assimilated to the detriment of calcium ; it has the added disadvantage of combining with certain fatty acids to form non-soluble calcium soaps.

Iron

Iron is another extremely important mineral, especially in those countries where iron deficiency is prevalent. The iron contained in human milk has a high level of bioavailability, thanks to complex phenomena (the action of lactoferrin, acidity of the digestive track, presence of appropriate proportions of zinc and copper), and iron-deficiency anaemia is extremely rare during the first four months of life in at-term breast-fed infants. The coefficient of uptake of the iron in breast milk may be as high as 70 %, whereas it is only 30 % for cow's milk and infant formulas.

In the present state of knowledge about trace elements, there does not seem to be any risk that suckling infants will develop a deficiency or overload for any of these ; human milk is richer in copper, selenium and cobalt, for instance, than cow's milk. Recent research has shown that breast milk concentrations of trace elements may serve as references for the estimation of infant requirements.

Vitamins

Vitamin concentrations depend on the mother's diet, for the most part. Many mothers do not eat enough fats, and this may affect the fat-soluble vitamin content (including vitamins A, D, E and K) of their milk. Human milk contains more vitamin A than cow's milk, with the possible exception of groups where serious deficiency prevails. Studies have shown that vitamin A deficiency is more frequent in infants who are weaned at an early age than in those who are breast-fed for several months. On the whole, the fat-soluble and water-soluble vitamin content (vitamin C and the B group) is almost always sufficient for coverage of the infant's needs. The most efficient, least risky and least expensive means of preventing vitamin deficiencies in breast-fed infants remains the improvement of the diet of lactating mothers.

To close this brief summary of the nutritional advantages of breast milk, it may be said that breast milk is biologically highly appropriate for infant feeding and that in most cases the mother's nutritional status scarcely influences the amount of milk produced. Apparently only mothers with severe, chronic malnutrition secrete insufficient amounts of milk. However, it should be stressed that while breast-feeding affords children with the best chances of satisfactory growth, it does make considerable demands on the mother, and it is therefore important that attention be paid to the diet of lactating mothers.

Amount of milk secreted

Once lactation has come into the final stage - toward the end of the first month - the average amount of milk produced is assessed at about 600 to 800 centilitres a day. This volume varies with the infant's appetite, but also with the frequency and intensity of feeds.

The question that arises is the effect of the mother's nutritional status on the amount of milk secreted. In one collective study conducted by WHO on the quality and quantity of breast milk, a decreased volume was only found in seriously malnourished mothers. In a study of some very poor parts of Zaïre, H. Vis, P. Hennart et al found that mothers with an albumin concentration of less than 30 g/l - the normal figure being 35-45 g/l - and a low weight gain during pregnancy (an average of 2 to 3 kg instead of 9 to 12 kg) produced 500 to 550 g of milk per 24 hours, on the average, whereas women with a better nutritional status and the same ethnic origin produced 600 to 700 g. In those areas where undernourishment is chronic, the amount of milk produced is substantially affected by the mother's diet, and is subjected to seasonal variations : it decreases during the pre-harvest period, when food intakes are low. The fact that these women accumulate very little or no fatty reserves during their pregnancy should be emphasized.

Recent research has shown that infants whose growth is normal and who are breast-fed by mothers with a satisfactory nutritional status are capable of considerable modulation of the amounts of milk ingested, whereas during the same period - between ages one and four months, approximately - the daily ration of bottle-fed infants is increased substantially. The short and long-term risks of this heavier diet are not yet well known, particularly with respect to obesity. It seems that when the amount of breast milk secreted drops, its energy density increases. In any case, it is extremely difficult, methodologically speaking, to study quantitative milk production, and to interpret the findings, given the complexity of the factors involved.

Maturity of the infant's digestive system

For infants, the first 4 to 6 months of life represent a transitional period between foetal nutrition and a mixed dietary regimen composed of a gradually increasing proportion of solid food. It corresponds to a period of adaptation and learning, similar to that encountered by infants in other spheres, when a function develops in response to stimulation. The notion of a learning process is encountered for psychomotor development, language, the visual function, etc., as well as for eating. But just as for any other stimulation, there is a key period, and proper timing to be respected : herein resides the difficulty.

Throughout its intrauterine life, the foetus is fed by the placental blood stream, which provides the necessary nutrients coming from the mother's blood. The most important of these are the amino acids, which are directly assimilatable, and glucose, the main source of energy. The waste is returned to the mother's blood stream.

The anatomical and functional development of the child's digestive and excretory system occur gradually in the course of gestation. They are prepared to function, but are not completely ready to do so at birth, since they were not needed until then : the foetus has no need to ingest, absorb or digest food, nor to excrete waste.

At birth, the infant must cope with the beginnings of its digestive and excretory functions, and with adjustment to the outside atmosphere, with the problems related to homeostasis, temperature, water, electrolytes, etc. entailed by this process.

While the foetus seems capable of swallowing-like movements toward the end of gestation, this function will not be put to use until birth. Immediately thereafter, sucking and swallowing are possible, thanks to a lengthening of the velum of the palate and the development of sucking and swallowing reflexes involving the lips, cheeks, tongue and pharynx. Reflex refusal is also seen during the first months ; that is, when offered semi-solid food, the infant extends his/her tongue forward and prevents the food from descending into the mouth cavity. This reflex disappears toward the fourth month, and food may then be swallowed. Chewing movements are developed toward age seven months.

Digestion of carbohydrates

Despite the presence of amylase in the infant's saliva, the digestion of carbohydrates does not take place in the mouth and oesophagus. Amylase activity in the small intestine is quite slight, and there does not seem to be any pancreatic amylase secretion before the third month. Taken together, this all explains why infants need an adjustment period before they can digest starches without suffering any digestive discomfort. Infants are definitely capable of digesting the different sugars, such as glucose, galactose, maltose, saccharose and lactose, on the other hand.

... of proteins

Proteins are digested in the small intestine, just as in adults. At first, one of the difficulties encountered in the use of cow's milk is the digestion of casein, which requires the ingestion of larger amounts to achieve a nutritional effect equivalent to breast milk. Despite the lack of problems in digesting proteins, overloading should be avoided since it makes greater demands on the liver and kidneys.

... of lipids

After birth, lipids contribute part of the energy ration. They represent 40 to 50 % of the energy content of breast milk, and are partially digested with the help of the lingual lipases secreted by the papillae located on the posterior part of the tongue, and by a lipase contained in the milk itself. This mechanism temporarily compensates for the immaturity of the pancreatic and hepatic functions. It is less efficient with milks other than breast milk.

It should be recalled that the lipase in breast milk is active in the assimilation of vitamin A. Furthermore, the bioavailability of iron is far superior in breast milk, in comparison with cow's milk or with enriched infant formulas.

Before birth, the renal functions regulate the volume and composition of the body fluids (this is automatic in the womb), and the excretory functions of the kidney are not yet fully effective. They are adapted to a breast milk diet, however, since it produces little waste. Gradually, the kidneys become more active, and their volume increases rapidly. Despite diminished glomerular filtration and

concentrating ability, the neonate's kidneys are effective in retaining water and thus preventing dehydration. This immaturity soon disappears, and the kidneys are able to cope with the demands made on it by the evolution of the diet, which should nonetheless be very gradual.

In conclusion, then, during the early months infants' nutritional needs are both very great and very specific in proportion to their body weight, whereas the organs responsible for eliminating the wastes produced by the breakdown of food and the functioning of the body (the liver and kidneys, in other words) are not yet able to function fully, but will gradually reach that point.

ANTI-INFECTIVE ADVANTAGES

The nutritional importance of breast milk for infants has long been emphasized. However, present scientific knowledge also points to its immunological benefits, which provide us with an additional reason to admire the system of intimate, appropriate relations characterizing the mother-child dyad. During pregnancy, not only is the child fed continuously, but it develops at the right temperature, and moves in a protective environment and a highly privileged milieu. During intrauterine life, specific and non-specific defence mechanisms are developed, but remain immature. Since the neonatal immune system has never been solicited, it is unable to function at birth. This explains why neonates are particularly sensitive to bacterial and viral infections. But as we know, the mother's antibodies cross the placental barrier and protect the child at the start. If the neonate is lucky enough to be breast-fed, the mother's milk will then quite naturally follow suite.

The protection afforded by breast-feeding is extremely important during the first weeks of life, and it depends on the frequency of feeds and on the duration of this type of feeding. While the concentration of protective factors declines as weeks go by, it is compensated by increases in the amount of milk taken by the child. Any study of the protective effects of breast milk must carefully distinguish between bottle-fed infants, those who are exclusively breast-fed and those who receive a complement.

The anti-infective properties of breast milk reside in some soluble factors and other, cellular factors. The most important soluble factors are immunoglobulins, and especially IgA, lysozyme, lactoferrin and some other immunological factors such as complement and interferon, as well as the bifidus factor, necessary for the growth of lactobacillus bifidus. The cellular factors are the macrophages, lymphocytes and various epithelial cells. All of these constituents abound in the colostrum, and represent up to half of the protein available at the very beginning of lactation.

Immunoglobulins, or antibodies, are proteins involved in defence, divided into several categories, each with its own specialization (IgG, IgA, IgM, IgD, IgE). The IgM and IgG, present in small amounts in human milk, attack and neutralize aggressors entering the tissues. Their concentration declines rapidly, early in lactation.

The IgA are specially important (cf. figure 8). When a pathogenic germ (bacteria or virus) enters the mother's body through the nose or mouth, she responds by producing specific antibodies, the IgA or secretory immunoglobulins, with the help of the lymphocytes located in her bronchial or intestinal mucosa. Adult women have areas of lymphoid tissue, known as Peyer's patches, containing these lymphocytes, scattered along their small intestine. When stimulated, these B lymphocytes (BL), which have been marked by antigens which generated their differentiation, consistently secrete the same antibodies ; they migrate to the blood stream, enter different parts of the body such as the bronchi and the intestine, and also the breast milk. There, these B lymphocytes are differentiated into plasmocytes, and produce antibodies capable of specifically attacking the maternal antigens encountered initially. The infant will be protected against the same external aggressions encountered by his/her mother, then. It is therefore most important to be aware and to teach others of this role of immunoglobulins, and of broncho- and entero-mammary circulation.

The IgA coat the infant's intestinal lining completely, so that pathogenic germs cannot enter and colonize it. In fact, the proteolytic enzymes do not attack these IgA, which may be found intact in the stools of breast-fed infants.

Lactoferrin binds iron, and competes with certain germs which also need it : it prevents their proliferation, thus playing a bacteriostatic role. Lysozyme kills some species of bacteria.

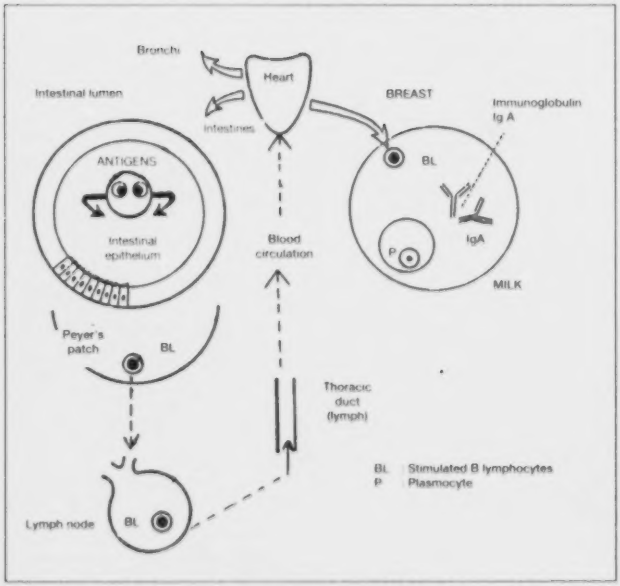

Figure 8 : Broncho-entero-mammary circulation.

Broncho-entero-mammary circulation once again provides evidence of the need to respect the strong, well-conceived mother-child dyad, not only so that lactation may begin and provide nourishment for the neonate, but also to afford protection against the same germs as those encountered by the mother. It is clearly an aberration to separate infants from their mother at birth, and yet this is far too often still the case.

The composition of breast milk is adapted to the infant's needs. One of the difficulties encountered by manufacturers in attempts to imitate human milk resides in these immunological variations as well as in nutritional variations. Recent studies have

shown that the volume of milk secreted is regulated by the child in accordance with his/her needs, both over the entire day and during each feed. Furthermore, the composition of milk changes as time goes by, from one feed to the next, but also in the course of a feed and from one breast to the other.

For many generations, small children have been fed the milk of other animal species, and of cows in particular. The composition of cow's milk is very different from that of human milk, not only in quantity, but in the composition and structure of its different constitutive elements (cf. table 2).

At present, many economically advantaged homes use infant formulas which have been so substantially modified that they are no longer called milk. The protein concentration of the original cow's milk has been lowered, and the casein content varies from one brand to another. The lipids have been substantially replaced by vegetable oils, which are richer in unsaturated fatty acids, the carbohydrates are mostly lactose, but above all, cow's milk is poor in minerals. Their vitamin content is matched with that of human milk. All are iron-fortified.

PSYCHOLOGICAL ADVANTAGES

Since infections and malnutrition are the conditions which most frequently undermine children from underprivileged backgrounds, it is only normal to devote much time to understanding the role that breast-feeding may play in preventing these risks : this does not mean that the psychological, emotional advantages should be underestimated. Jelliffe has reminded us that breast-feeding is a means of psychological communication between mother and child. With the present better understanding of the role played by psychological factors in children's development, even if these cannot be easily measured, the benefits of intimate mother-child contact during nursing are more evident. The mother looks at her child, smiles, talks to him/her. As the child suckles, he/she touches the mother's skin, smells her odour, feels her heat, hears her heartbeat. A loving relationship is established. There is no doubt that this relationship exists even if the infant is fed artificially, but the contact is less intense, reciprocal and sensual.

Babies are born knowing how to suckle : they seek out the nipple, using both nose and mouth. This burrowing reflex is basic to the beginning of breast-feeding. The sucking reflex peaks shortly after birth. The mother-child communication is ongoing : at first, the mother monologues, and she is answered by the baby's first attempts, after which a dialogue is gradually established. These tactile, visual and olfactive exchanges actively contribute to the feelings of well-being and security so necessary to full human development.

In the act of nursing, not only does the infant express his/her satisfaction, but the mother too expresses her pleasure. Investigations on the motivations underlying breast-feeding very often mention the mother's happiness at putting her child to the breast, the profound emotion accompanying this particular way of communica-

ting her affection, her joy at continuing to create her child, at getting to know him/her better, and developing a special relationship with him/her.

The uterine period is called the "red blood period", and the first months of life form the "white blood period". These images lend flesh to one essential idea expressed by Robert Debré, when he said that a child's life begins at conception, not at birth. Every attempt should be made to preserve the unity of the mother-child dyad during the first years of life : breast-feeding, the normal extension of pregnancy, is part of the whole that is motherhood.

MOTHER'S NUTRITIONAL STATUS AND LACTATION

NUTRITIONAL NEEDS OF LACTATING MOTHERS

The theoretical nutritional needs of lactating mothers may be evaluated as follows. If a mother is to produce an average of 700 to 850 millilitres (ml) of milk a day, with an energy content of 65 kilocalories (kcal) per 100 ml, she should receive an extra energy intake corresponding to the energy content of the milk secreted, plus the amount of energy required for its production. The metabolic modifications and the reserves accumulated during pregnancy reduce the energy cost of lactation. In 1981, the FAO and WHO recommended a food supplement of 500 kcal a day and a protein supplement estimated at 20 g of the usually eaten proteins. These figures are theoretical, however, since needs depend on the mother's nutritional status, her reserves, her diet and living conditions.

Mothers seem to have a better metabolic efficiency during lactation than in ordinary times, as if they make better use of what they eat. Women who practice exclusive breast-feeding and eat what they like have highly contrasting caloric regimens. It is probable that nutritional needs vary from one woman to another.

Some breast-fed infants with satisfactory growth curves have mothers who do not lose weight, although their diet does not conform to international recommendations. More research into the reserves and metabolic functioning of mothers is definitely needed.

One question which arises repeatedly is whether an undernourished mother is capable of breast-feeding, and for how long a time. International recommendations advocate exclusive breast-feeding during the first 4 to 6 months, followed by the introduction of complementary foods, while pursuing breast-feeding. On the basis of some scientific research, the international organizations tend to go even farther, and to recommend exclusive breast-feeding until age 6 months. The main objective of this policy is the protection of children, but do we know enough about the influence of lactation on the mother's organism? We have reviewed the many advantages of breast-feeding for the child. Let us now take a look at the mother's health.

MATERNAL NUTRITIONAL STATUS

The mother's nutritional status during pregnancy is fundamental for her health, for her child's future and for her ability to nurse. One indicator of mothers' nutritional status is their weight gain during gestation.

Weight gain

Mothers gain weight during pregnancy. In the industrialized countries and among affluent women in developing countries, the mean increment is about 10 to 13 kg. This weight gain is often far lower in underprivileged women, and has been evaluated at 5-6 kg or sometimes even less in some areas. This variation first affects the fatty reserves. These reserves, stored up during pregnancy, are used by the foetus during its period of rapid growth, but also for the mother's energy expenditures linked with milk production.

Many studies have shown that pregnant women do not seem to eat more during this period. Some women actually cut their diet down, out of fear of having a difficult delivery if their baby is too heavy, or because they do not want to spoil their figure. But studies of women who do not have this attitude actually come to the same conclusions. At the same time, nutritionists recommend an increase in the caloric ration. For underprivileged women with a very low intake, a poor nutritional status and a high energy expenditure, this seems logical.

During pregnancy, an enormous quantity of new tissue must be built up (uterine tissue, mammary glands, placenta, foetus). This growth mostly occurs during the last trimester of gestation. Several studies have shown that expectant mothers not only store fats, but also proteins, which are often transferred later to the foetus : there is an early, anabolic phase, followed by a catabolic phase. The difference between the needs entailed by this build-up of new tissue and the lack of increased dietary consumption seems to indicate that modifications in the maternal metabolism occur during pregnancy so as to ensure foetal growth. Perhaps this adaptative mechanism is a means of protecting the foetus by spreading the concrete cost of its development over its entire gestation, whereas needs are concentrated at the end of gestation.

Weight and height

Monitoring of weight is a part of the antenatal consultation : mothers are weighed and the results interpreted. This requires that their initial weight be known, for two reasons : first, for the interpretation of the weight gain, to determine whether it is sufficient, and secondly, to orient counselling, since advice on how much weight to gain is not the same for a mother with a satisfactory nutritional status and for those who suffer from malnutrition, however slight. Women whose prepregnancy weight is low should gain more during pregnancy than those with an acceptable weight, or who are overweight. A person who weighs 45 kg is not in the same situation if he/she measures 1 m 50 or 1 m 65.

However, it seems that knowledge of the mother's prepregnancy weight and some indications of gains in the course of pregnancy (the number of weighings depends on health coverage by antenatal consultations) are insufficient for the interpretation of these findings.

In areas where malnutrition is prevalent, height may be viewed as a good indicator of an individual's nutritional status during childhood. Weight for height is an index that shows whether an indivi-

dual is thin or overweight (cf. figures 9 and 10). It is used for monitoring weight gain during pregnancy, in comparison with the initial weight/height ratio.

A public health policy whose goals include the reduction of maternal morbidity and mortality over not too long a term would be greatly helped by measurement of the weight for height ratio of women in their reproductive years, with special attention to adolescents and primiparas, so as to detect those with a low index and formulate action aimed at increasing their weight before a possible future pregnancy.

For all of these anthropometric indicators, there remains the problem of setting cut-off values, so that the results may be analysed in accordance with local, national or international reference figures, and be compared with others.

Arm circumference

Weight and height are not the only maternal anthropometric indicators available. Arm circumference may be used for a rapid assessment of the nutritional status of women in a given region, or when a food-related emergency situation prevails (drought, famine, etc.). The cut-off values are between 21 and 23.5 cm. This circumference seems to remain constant throughout pregnancy and is independent of gestational age, but its main drawback is its inaccuracy, since differences may be quite slight. At the individual level, the evolution of this indicator in the course of pregnancy does not yield any valuable information.

Programmes for monitoring women in at-risk situations are useful for the identification of exposed mothers, susceptible of giving birth to children with a low birth weight, and who will experience difficulties during lactation, so as to offer counselling and provide appropriate interventions. The indicators must be chosen with reference to living conditions : prepregnancy weight and height, weight gain, any infectious condition, iron status, interbirth interval (the amount of time elapsed between the last previous pregnancy and the present one), age, parity, educational level, etc.

It should be clear, however, that these indicators do not point to the causes of the risks, they only identify individuals who run a nutrition-related risk. The underlying causes must then be sought, and appropriate measures suggested.

Amount of milk secreted

A WHO study (1) on the quantity and quality of milk in different countries around the world shows that on the whole, the amount of breast milk is scarcely affected by the mother's nutritional status. Only a few studies in extremely poor rural areas where expectant mothers only gain an average of 2 to 3 kg found milk production to be lowered, although it does continue, nonetheless, for 18 to 24 months, with steady amounts. Given the extremely small reserves accumulated during pregnancy, these lactating mothers seem to depend exclusively on what they eat for their milk secre-

(1) Quantity and quality of breast milk. WHO, Geneva, 1987.

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tion, which then undergoes seasonal variations (harvest and pre-harvest periods). It should be emphasized that in those cultures where breast-feeding is a traditional practice, women who do strenuous work even if they are undernourished, and who frequently give birth to low-birth-weight babies, are practically all capable of secreting milk.

Quality of milk

Furthermore, again according to this study, mothers' nutritional status hardly seems to affect the carbohydrate, protein and lipid composition of milk : the energy content of milk remains constant. Mothers' dietary regimens apparently affect slightly the types of lipids present, which vary with their diet. Research on fatty acids would be most valuable. The trace element content of milk does depend on what mothers eat and on their nutritional status.

It is quite difficult to summarize all of the research on the influence of mothers' nutritional status, the volume of milk secreted and its quality, because of the multitude of factors involved : some pertain to mothers' status before and during pregnancy, others to their diet during the lactation period, as well as to their physiological condition, physical activity and a number of other parameters including age, interbirth interval, phase of lactation, etc. Further, research protocols themselves are difficult to formulate (methods for the analysis of milk have not been standardized, the composition of milk varies from one feed to another and in the course of a given feed, measurement of the amount of milk produced, etc.) and may contain hidden biases, since the very fact of contacting mothers may affect their milk secretion.

As a rule, however, it may be said that every woman can nurse her child. Infraclinical, mild or moderate maternal malnutrition does not seem to affect the quantity or quality of breast milk negatively.

Dietary supplements

One often-raised question is whether dietary supplements given to mothers during the lactation period really improve milk production.

About fifteen years ago, some investigations found that dietary supplements for lactating mothers were effective in improving the amount of milk produced, but no attention was paid to other factors, not even to nutritional status. At present, studies show that dietary supplements have only a slight impact on the volume of milk, except in case of severe malnutrition. For instance, a 750 kcal supplement given to mothers whose normal daily intake is about 1,500 kcal, a figure certainly close to the minimum, does not affect the amount of milk produced. Conversely, many studies point to the dangers of such practices. In the Gambia, Lunn et al attempted to achieve a quantitative increase in milk production through considerable improvement of the diet of chronically malnourished women. This hardly affected the amount of milk, but significantly reduced the prolactin concentrations without decreasing the frequency of feeds. Supplemented women experienced earlier ovulation and pregnancy. This reduction in post-partum amenorrhoea seems to be linked with the lowered prolactin concentration and not with the change in diet.

The primary factor for satisfactory lactation seems to be nutritional status before and during pregnancy.

In those areas where women are generally undernourished, with a very low prepregnancy weight (about 40 kg) and a very slight weight gain (4.5 kg on the average), breast-feeding must be preserved by all means. Since expectant mothers have no fatty reserves, they should be given dietary supplements from the start of their pregnancy, in an attempt to improve both their own nutritional status and the birth weight of the unborn baby, as well as to enhance the chances of quantitatively adequate lactation. Another possibility would be the reduction of their energy expenditures by relieving these pregnant women of hard labour, but this is even more difficult.

Another, complementary approach would involve providing dietary supplements for pregnant women and for lactating mothers, the purpose then being the improvement of the mother's health and nutritional status rather than increased birth weight or milk production.

Studies should concentrate on the nature of food supplements, to determine which ones yield the best results, with respect to both the amount of milk and the mother's nutritional status. Is it the proteins or calories that count? Should the aim be to compensate for the greatest deficiencies, to achieve a balanced diet ?

LACTATION AND PLANNED PARENTHOOD

The idea that breast-feeding is a reliable means of avoiding pregnancy is a long-standing one. However, some studies subsequently proved that pregnancy may occur during the lactation period, and that this method was not failproof. The fact is that a number of parameters are at work here : hormonal factors, the mother's nutritional status, how breast-feeding is managed, and, too, the cultural context.

The relative weight of each of these elements is not easy to determine, since it is also clear that they interact. In some traditional societies, both mother and child are surrounded by strict protective rules : lactating women must refrain from any sexual intercourse throughout the duration of breast-feeding - that is, for about 18 months. For this reason, custom may dictate that she be separated from her husband and sent away to stay with her parents, or, in other instances, that she be painted with a red substance prepared from the bark of a particular tree, to indicate that men must stay away from her. Be this as it may, any pregnancy occurring during this period meets with the strongest disapproval from her family. The muslim religion separates husband and wife for six weeks. The Bible prescribes a thirty-day purification period for the birth of a boy and sixty days for a girl.

Many studies have also shown that severe malnutrition tends to prolong post-partum amenorrhoea, but to a small extent : this defence (or protective) mechanism combines with a hormonal reaction.

Hormones

Physiologically speaking, the contraceptive effect of lactation is mainly due to the fact that the blood prolactin concentration remains above a particular threshold. This inhibits the release of hypophyseal gonadotrophins, thus producing no ovulation, amenorrhoea and delayed resumption of fertility. This description is valid as a generalization. On the individual level, however, there are substantial variations, and breast-feeding cannot be viewed as a 100 % reliable method, then. For a time, this unreliability discredited breast-feeding, since mothers were told it was definitely contraceptive, but were not given any more specific information.

Menstruation, ovulation and resumption of fertility are different aspects to be considered separately in any discussion of the relations between lactation and reproduction. Following delivery, the mother experiences a rapid drop in her placental hormones. If the nipples are not stimulated, the prolactin concentration declines, and the ovarian cycle resumes normally within six to twelve weeks of childbirth. There remains the question of whether menstruation occurs before ovulation, or whether ovulation occasionally precedes menstruation.

Following many epidemiological investigations, it is now recognized that 100 % of women who never nurse their baby are again menstruating three months after delivery.

Frequency of feeds

Conversely, if, after delivery, the mother nurses her baby frequently, at relatively close intervals, and does not give any other food, the prolactin concentration remains high, production of other hormones is blocked, and ovulation does not resume. If bleeding has not occurred before the 56th day after delivery under these same conditions, breast-feeding may be expected to afford 98 % protection against another pregnancy over the forthcoming four months. Before or after this six-month period, if menstruation begins or if the mother ceases to nurse, the risk of pregnancy rises. Breast-feeding should no longer be considered a planned parenthood method, and another means sought.

If lactation is pursued beyond six months, although no longer exclusively, of course, infertility seems to decline after awhile : there is then a risk that fertility will resume before menstruation occurs.

Some surveys have indicated that the risk of pregnancy among lactating women experiencing lactation amenorrhoea in developing countries does not exceed 10 % at 6 months. It seems that as delivery recedes into the past, the number of cases of ovulation before menstruation increases. Research shows that beyond the six-month point, 2 to 12 % of lactating women become pregnant again before they menstruate.

The question of when fertility resumes is a delicate one, then, in the perspective of continuing breast-feeding as long as possible, making optimal use of its anticonceptional advantages to increase

the interbirth interval and to foster biological and physical (health) recovery for the mother, while advising against the use of contraceptives.

In most cultures, another pregnancy is a cause of weaning, for behavioural reasons. Families view pregnancy and lactation as incompatible : the milk is then considered to be spoiled, and harmful. Biologically speaking, these are two tremendously demanding experiences, particularly since they often affect women whose nutritional status is precarious. If a lactating woman becomes pregnant, she should be given the following advice : above all, the child should not be weaned suddenly, appropriate food should be introduced gradually if she cannot continue to nurse him/her, she should attempt to improve her own calorie intake and to reduce her work load.

Barrier or hormonal contraception should not be prescribed too soon, either, since they would be redundant with breast-feeding. These are costly methods, and furthermore, many women find it difficult to use them for long periods of time : hence, it is preferable to reserve them for the most important periods of time.

Nutrition-related policies advise mothers to nurse, to increase their interbirth interval so as to promote breast-feeding and nutritional recovery. However, nutrition and planned parenthood should be included in programmes for training health personnel and for informing the population, as well as in interventions, at every level, and the complementary nature of these different actions emphasized.

Lactation and contraception

During lactation, non-hormonal planned parenthood methods are most appropriate : these include condoms, diaphragms, IUDs, etc. IUDs should not be inserted within six weeks of delivery, since they may be expelled and/or perforate the uterus. If hormonal methods are used, progestogen-based pills should be preferred. Studies show that only slight amounts of the progestogens cross into the breast milk, and these do not seem to have any pernicious effect on infants. Conversely, they seem to stimulate milk production. When lactation is not well established, it is preferable to refrain from these methods, and to reject combined oral contraceptives (oestrogens plus progestogens) when possible. Injectable contraceptives (such as depo-provera) do not affect lactation, except by increasing it.

MANAGING BREAST-FEEDING

The decision to breast-feed is not a last-minute one. Two types of situations are encountered :

- the mother lives in a culture where infants are naturally, traditionally fed in this way, and she finds it quite normal to nurse her child. There is no alternative, and the question does not even arise ;

- the mother thinks about how she will feed her child, she makes a choice, and whatever her decision, she prepares for it. This situation increasingly tends to prevail. She frequently needs help in making her choice, particularly in the case of young, perhaps adolescent mothers, primiparas, and those living in underprivileged areas. Mothers who failed in a previous attempt to nurse another baby usually do not favour another try. It is important, then, to diagnose the causes for giving up lactation and when this occurred. Often there was a problem with managing it.

Telling a mother "you should nurse your child, breast milk is best for it" is not enough. She must be told why this is the best food, informed on the technique of breast-feeding and on the difficulties involved. Sensitizing mothers involves providing information, enhancing their awareness and also, answering their more or less explicit questions. Mothers cannot be forced to nurse, particularly so since the mind plays such an important role in milk secretion. A motivated mother, well aware of the advantages of breast-feeding over substitute milks, has the best chances of doing well during this period. Indeed, the idea is not to breast-feed for one week, but to overcome all of the difficulties encountered, and to go on happily nursing.

When a mother decides to breast-feed, she should be helped to prepare for and manage this situation. However, if she finally decides to bottle-feed, she should also be helped to do so under the best possible conditions, with the knowledge that the task will be more protracted and heavier for everyone involved.

PREPARATION

If a mother has never breast-fed or has questions about this type of feeding, the preparation should take place during pregnancy. When antenatal consultations exist, this should be one of their main activities, but it may also be done in women's clubs or within any other association.

Too often, antenatal consultations are only viewed as a time for hasty signatures, laconic prescriptions and routine examinations, which do not lead up to an interpretation of findings, accompanied by judicious, appropriate advices. In the old times, information on motherhood and how to handle it was passed on to younger women by their elders ; this information may seem minute, but in fact the example, along with day-to-day responses to questions and problems, the role of imitation in family education, were all fundamental. This now tends to disappear, and other systems must be found.

Monitoring weight gain

Antenatal consultations should include the monitoring of weight gains with respect to the mother's initial weight and her weight/height ratio. The Rosso system may facilitate the interpretation of these data. An individual's weight/height chart may yield an indication of his/her energy balance during the previous weeks or months (cf. figure 9).

This indicator in itself cannot diagnose malnutrition or obesity, but it points to a deficient or excessive caloric intake, in comparison with nutritional needs. If the ratio is under 80 %, action is required. Between 80 and 90 %, action should be decided if the necessary resources are available, since this ratio at the start of a pregnancy indicates a risk of low birth weight. A ratio over 110 % is a sign of overweight, meaning that the energy consumption exceeds caloric needs.

When using this chart, it is important to be aware of its limits. First, as for any reference, one must make sure it is appropriate for the population on which it is used. Secondly, it does not take into account the ratio between fatty mass (adipose tissue) and lean mass (muscles). Despite these remarks, this indicator remains one of the best means of identifying at-risk mothers and orienting counselling on nutriture and physical activity.

During pregnancy, Rosso's charts may be used to monitor weight gain and facilitate the interpretation of the data collected (cf. figure 10). Paths have been defined on the basis of serious risk of low or excessive birth weights, using mothers' W/H and their weight gain in the course of gestation.

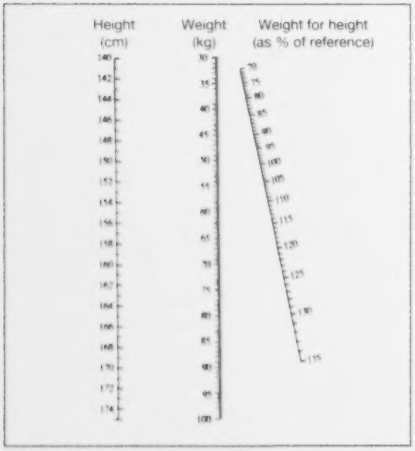

Figure 9 : Nomogram for calculating maternal weight for height (as percentage of reference (1).

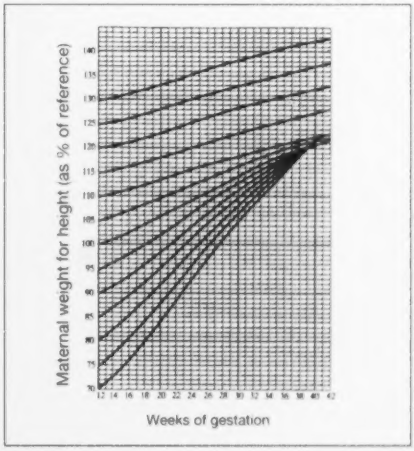

Figure 10 : Reference weight/height curves for monitoring weight gain during pregnancy (1).

(1) Rosso P.A. New chart to monitor weight gain during pregnancy. Am. J. Clin. Nut. 1985, 41 : 644-652.

Example : a mother weighs 63 kg and measures 162 cm before (or at the beginning of) her pregnancy. The chart shows that her weight/height is 109 % of the normal. She consults at 28 weeks of pregnancy. Her W/H should be 117 %. She weighs 66 kg at the time, which corresponds to 115 %. The pregnancy is going well, in this respect. This does not preclude any other complications such as anaemia, etc.

Examining the nipples

The appearance and flexibility of the nipples is checked. Their shape is looked at, then the areola is pressed on both sides of the nipple, to make sure that it stretches to form a teat. If it does not extend out, the woman should be shown what exercises to do, twice a day if possible. A finger is placed on either side of the nipple, and the skin and underlying tissue stretched outward toward the left and right ; the same movement is then repeated up and downward. This should be done several times. This gentle massaging and shaping, through which the nipples are pushed, pulled and pinched, usually improves retracted nipples. It is essential that the mother be reassured, and then watched and helped if necessary during the first feeds.

PUTTING THE INFANT TO THE BREAST

Starting suckling immediately

Some rules must be observed when putting the newborn to the breast. This should be done within an hour of birth, rather than waiting several hours, or even days, as prescribed by tradition, and as recommended by many paediatricians and midwives : the latter practice involves a risk of hypoglycaemia. Nor should fasting be prescribed ; neonates should not be bottle-fed with sweetened water or cow's milk, either. This would accustom it to a sweeter taste than breast milk, and to a lesser effort, since it is much easier to suck on a teat than on a breast. Furthermore, in many cases this unnecessarily exposes neonates to the risk of diarrhoea. When put to the breast immediately, the infant's sucking rapidly contributes to starting milk secretion, and the child may then take advantage of the colostrum. Any other fluid intake may interfere with the beginning of the lactation process.

Contact with the breast

The breast should be properly presented to the neonate. Care should be taken to avoid obstructing of the baby's nostrils, and the nipple drawn into the mouth so that sucking is efficient. The mother offers her whole breast, and the baby's mouth should be able to extend beyond the nipple, to cover much of the areola so that the pressure of the tongue will help to push the milk out of the lactiferous sinuses. The nipple is then in contact with the palate ; the baby's body should be turned toward the breast, and the head be able to move freely. Attention should be paid to the risk that spurting milk at the beginning of the feed may cause discomfort. Placing the baby in a satisfactory position is very important for proper sucking, for mutual well-being and for the prevention of cracked, inflamed or congested breasts. If the mother has never nursed before, she should not be left alone for the first feeds. She must be taught to position herself comfortably, to hold her child correctly and be given technical help. The nipple, a highly sensitive part, may become painful after 8 to 10 feeds. This pain goes away after three or four days.

The baby should be allowed to suck slowly and calmly. Once a child has taken as much milk as desired, he/she lets go of the breast spontaneously. There is no need to time the feed, the baby sets his/her own pace : some babies take 5-10 minutes, others need a half-hour. The amount of milk ingested is approximately the same for slow and fast drinkers. The baby should be allowed to take advantage of the differences in the composition of milk in the course of the feed : as seen above, the milk at the end of the feed is richer in lipids, as if to produce a feeling of fullness. The child should not be deprived of this energy.

After delivery, the neonate should live in the same room as the mother, and even in the same bed, if this is customary. This makes the early phases of suckling easier, contributes to the development of emotional ties, through physical, visual and olfactive contact, and helps to protect the child against the same germs, through the entero- and broncho-mammary cycles.

Self-regulated breast-feeding

The mother should feed her child on request - that is, whenever he/she cries or is restless - so that he/she may develop a specific rhythm, different from that of other children : some demand the breast very frequently, others rarely during the early days. It is the infant's appetite that commands the schedule : self-regulated and observation of the infant by the mother create a balanced feeding schedule. At first, suckling on request results in about 10 feeds per 24 hours.

It is preferable, during the first days, to have the child suck both breasts so as to activate them. Most infants, especially heavy ones, request both breasts at each feed. If this is not the case, one breast should be completely emptied at each feed, so that the infant may benefit from the milk at the end of the feed and also to avoid congestion or drying up, caused by insufficient stimulation. Breasts should then be alternated, so that each breast is properly emptied at least every other feed. Night feeds help to maintain the prolactin concentration and therefore contribute to milk secretion and to contraception. Further, if the mother must resume outside work, feeds at night, early in the morning and as late in the evening as possible may help to sustain lactation and to nourish the child.

For many years it was believed that exclusively breast-fed infants living in hot climates needed extra water to avoid dehydration. Studies conducted in Argentina, Peru and Jamaica, under living conditions where temperatures were high (between 26 and 41°C) and humidity variable (between 15 % and 96 %), have shown that infants did not need any extra fluid : all had normal urine concentrations. Breast milk satisfies all of the infant's needs for nourishment and water during the first 4 to 6 months of life. Any additional fluid would expose them to an increased risk of diarrhoea and may incite them to suck less energetically.

The use of artificial teats during the first weeks may lead to "teat confusion" and rejection of the breast. The habit of giving fruit juices during the early months is also unfortunate, since the risks are greater than the benefits.

No complementary food is necessary before age 4 to 6 months : it is in fact dangerous. Too often, people are not aware that the more the child sucks at the breast the more milk is produced by the mother. Mothers often believe that mixed feeding will enable them to economize their milk, to store it up. This is physiologically false, and should be explained to mothers. Recommendations for successful breast-feeding have been draughted (cf. appendix 2).

POSSIBLE DIFFICULTIES

The biological absence of milk is extremely rare, and yet it is one of the reasons most frequently alleged by mothers. When a mother says "I do not have enough milk", she must be helped to analyse the reasons behind this assertion. To determine whether the child has taken enough milk, the mother should be asked how many times a day he/she urinates : 7 to 9 times is an average figure. The child's growth may also be assessed, by weighing, checking the number of feeds (often insufficient) and their duration (some babies rapidly fall asleep on the breast, some mothers do not leave them there long enough). Sometimes the mother has simply lost faith in nursing, and she must be helped to regain confidence.

When delivery is premedicated, the mother, and sometimes the child, may be listless during the first day. Physicians and midwives should not exaggeratedly premedicate, when possible, since this may affect the infant's muscle tone, and detract from proper sucking.

During the first week after delivery, the main cause of hypogalactia is poorly managed breast-feeding. At any rate, it is not by drinking more, except if she is thirsty, that the mother will increase her milk production, as some customs suggest. In many cultures, one key point occurs when mother and child return home, and which often coincides with the abandoning of breast-feeding. Attempts at follow-up of mothers during the first weeks, through home visits by mother's helpers or specially trained volunteers have yielded major improvements. The objective is to observe the material or psychological problems encountered by mothers when they return to their home, to provide help in solving them, to prevent them when possible, and to answer any questions. Mothers should feel that they have support, and can discuss their difficulties with a person they trust, and who comes to visit them at regular intervals. Another delicate period is the resumption of menstruation.

Returning home

The breasts must be inspected during the early period, to prevent and detect those minor complications which may occur at the onset, and endanger the pursuit of breast-feeding : tension in the breasts, painful or cracked nipples should be watched for. Cracking usually occurs during the first week, and is the leading cause of discontinuation, along with congestion. There are simple methods for preventing cracking. No soap should be used to cleanse the nipples : they should simply be rinsed in a little water and carefully dried : antiseptics dry the skin (by removing the secretions produced by Montgomery's cells), which then cracks more easily. Proper positioning of the infant during the feed also plays a major role.

Congestion, cracks, fissures

If cracks or fissures do develop nonetheless, the baby should momentarily not be put to the ailing breast, which should be aired whenever possible and kept dry. If some congestion then occurs, the breast should be emptied by hand, but never using a milking machine.

Congestion must be avoided at all costs, if ongoing lactation is to be ensured, and the aesthetics of the breasts preserved. A lactating woman should not have over-swollen, extremely tense, hard and painful breasts, since this is unpleasant and increases the risk of stretch marks and of subcutaneous tissue damage. Here again, the best solution is the encouragement of frequent feeding, with complete emptying of the breasts. If necessary, this may be done by hand, under a warm shower. Wearing of a brassiere also helps to avoid the stagnation of milk in the ducts.

It should be remembered that there is a very definite relation between the woman's happy emotional and sexual life and a satisfactory lactation process.

Despite this presentation of all of the difficulties involved, which are in fact infrequent, nursing one's baby should remain a pleasure, a source of happiness, and a decision made jointly by the couple.

ACTION FOR THE PROMOTION OF BREAST-FEEDING

If we wish breast-feeding to continue to progress, in terms of prevalence and duration, the efforts made over the last two decades must not be slackened. Research must be intensified, especially with respect to the influence of breast-feeding on the mother's fertility and nutritional status, so that coherent intervention programmes may be built on a solid basis. This can only be done through the use of reliable scientific methods, and by correcting, whenever necessary, any unsatisfactory practices and routines which have developed either at the family and community level, or within the health services.

Two other sectors should further improve their action in favour of breast-feeding : the information and education sectors.

Informing mothers

If mothers are to be helped to make use of (or to rediscover) breast-feeding - their own physiological function - the overall mentality and psychological climate in their community must be conducive to it, and it must be understood as the natural act it really is. Mothers must encounter comprehension and receive effective support from people around them, and especially from their spouse.

Beware of advertising

This means that advertising must change, and not constantly portray the baby bottle as an instrument of women's liberation, and breast-feeding as old-fashioned. Why not show happy mothers nursing their babies, instead of beautiful bottle-fed babies? Sex education courses should provide information on lactation and on breasts as organs for breast-feeding rather than simply as erotogenic organs, etc.

Giving the example

In the developing countries it was the most affluent classes which first began to replace breast-feeding by the baby bottle, which was viewed by some mothers as the secret for having a beautiful baby and the sign that they were modern. And it is they who, by their example, could make breast-feeding fashionable again, for there is nothing like an example, where education is concerned. Who, better than a woman who has nursed her children, can convince those around her of the value of this act? In the industrialized countries, it seems to be the best educated mothers who are now going back to breast-feeding, precisely because they are informed of its advantages. They must be counted on to explain the psycho-physiological and emotional benefits of breast-feeding.

Social encouragement is difficult to obtain, since knowledge of the importance of breast-feeding is still quite insufficient.

Promoting breast-feeding

Education campaigns must reach influential people within the community : the administrative authorities, people in managerial positions, nurses, teachers and physicians must be informed on research in this field, on what is known, to date, about the psycho-physiology of lactation, on the cost of malnutrition and diarrhoea resulting from artificial feeding, in terms of work overload for the health services. Economists and planners should be informed of the value of breast milk so that women may be helped to nurse (through maternity leaves). The food industries must be made aware that their advertising for infant formulas and foods may be harmful to certain social strata in developing countries.

Educational messages should not confine themselves to the nutritional and health advantages, but should emphasize national pride, renewed authenticity, success, approval by the traditional religious authorities, etc. It is a good idea to obtain the support of reknowned and admired women within the community who have nursed their own children (wives of statesmen and political leaders, chairwoman of the Women's Association, etc.). The available means of communication - radio, newspapers, television, when it exists, village meetings, etc - should be used. Facilitators working on rural projects should be adequately informed on these issues.

Training workers

In medical schools and those training other health professionals, infant feeding is mentioned on the curriculum, but the amount of time devoted to breast-feeding in comparison to feeding with manufactured infant formulas is not specified. Textbooks should also provide solid scientific arguments on breast-feeding, instead of devoting only a few lines to it.

An effort at training has already been undertaken, and it must be intensified, so that the entire health personnel will have solid, clear, recent and concrete scientific bases so as to be able to respond to the questions or arguments of future mothers, and to help them to solve (or prevent) any problems they may encounter.

The health sector

It is not easy for health workers to be educators working toward breast-feeding, for a number of reasons. Their training does not devote enough time to this subject, team work involving obstetri-

Organizing health units

cians, paediatricians and health workers is not yet sufficiently intensive, the link between maternity hospitals and mother and child care services is not established in most cases, and last, heath officials are dubious about the need for popular education and about their own role in it. Furthermore, the organization of health services is not yet conducive : suckling babies are rarely hospitalized with their mother. Any childhood disease requiring hospitalization results in weaning. The same is in fact also true in maternity wards, where there are still too many instances of newborns separated from their mother.

Last, infant nurses and nurses have work schedules which are an obstacle to their personal home life as mothers, and do not necessarily enable them to continue breast-feeding and thus to serve as examples.

Too often, mothers do not opt for breast-feeding out of fear of having to change over to the bottle when they go back to work. They must be persuaded that for the child, 4 or 12 weeks of breast-feeding is an irreplaceable experience, and one which is well worth the effort, especially because of the immunity (defence against infections) afforded by breast milk.

In almost all reports on industrialized countries, the decline of breast-feeding is practically ascribed to the indifference, lack of interest or even negative attitude of health workers, as well as to a lack of enthusiasm in the partner (husband) and among elderly people ; again, the underlying cause is a lack of information.

Convinced personnel

The people in frequent, close contact with mothers - the midwives, infant nurses, nurses and home visitors - have an essential role to play, and should work at preventing failures, especially between the 10th and 15th day, and during the 5th or 6th week. It should be remembered that in big cities 70 % of mothers begin nursing, and many discontinue it very rapidly. The personnel has a large share of responsibility in these cases. A great many of these drop-offs might be avoided by some counselling. This of course requires more of an effort from maternity ward workers than the distribution of ready-prepared bottles at set hours ; it is a change in behaviour involving thoughtful human presence, understanding, intuitiveness and readiness to do work that is less routine, and involves an attempt to sense the mother's feelings and the child's needs. All this contributes to the development of a trusting atmosphere conducive to the breast-feeding process.

Another occurrence to be watched for : infants who do not gain enough weight. Many paediatricians and midwives insist on having the child weighed at each feed, thus inducing some anxiety, which affects the mother's milk secretion. This is the whole question of the child "who did not drink enough" or "drank too much". It is important to record and interpret the weight curve, but this must not become an obsession, especially during the first few days, when suckling infants grow more slowly than those fed on cow's milk.

Manufacturers of infant formulas often aim their publicity campaigns at health workers, and view health units as ideal places for advertising their products. The most effective promotion technique involves having health workers distribute infant formulas. In May 1981, the national delegates to the World Health Assembly (WHO, Geneva) unanimously approved a code for the marketing of breast milk substitutes, baby bottles and nipples : this is a recommendation aimed at governments, for enforcement on their national territory, following adjustment. This was viewed as the minimum that might be done to protect healthy infant feeding practices (cf. summary in appendix 3).

SOME SPECIAL CASES

There are very few contraindications to breast-feeding.

A sick mother

If the mother falls ill during the breast-feeding period, the consequences for both mother and child of each possible decision must be examined carefully. In some cases of dire poverty, it may be dangerous for the child to cease suckling : the decision should depend on the degree of risk for the child, as compared with the dietary, immunitary and emotional benefits.

There are few reasons to treat a lactating woman, and it is usually possible to prescribe a medication that is compatible with breast-feeding. Mothers should be warned against excessive use of stimulants (tobacco, coffee) and against drinking, self-medication and lotions applied to the breasts. Much research has been done on the pharmacotoxicity of drugs taken by lactating mothers and possibly crossing over into their milk, thus affecting the child. This is a result of the drug's ability to cross the different barriers, and depends on low molecular weight, fat-solubility, the dose taken, etc.

If medication is unavoidable, the health team should find an appropriate solution for each case, depending on the drug needed, and following examination of a number of points. Is the treatment chosen the one presenting the least risk for the child? In case of a drug whose effects on infants are unknown, it is preferable either not to prescribe it or to discontinue breast-feeding. Combinations of drugs should be avoided in all cases, and it is preferable that suckling take place before ingestion of the drug if the latter is taken once a day and has a short half-life. The basic rule, then, is to prescribe as little medication as possible for lactating women.

Table 3 summarizes some contraindications.

Transmission of HIV infection by breast-feeding

Studies have clearly shown that the HIV virus may be transmitted from mother to child during pregnancy and delivery. Transmission of Aids from mother to child during the postnatal phase, probably through breast-feeding, has received less attention, owing to the difficulty in studying it. Several cases of transmission by the colostrum or breast milk have been reported : this occurrence is believed to be extremely rare, and connected with unusual circumstances such as maternal contamination during transfusion by contaminated blood in the course of delivery or afterward.

Table 3

Drugs contraindicated during lactation

Allergens	Danazol	Oral anticoagulants
Amiodarone	Derivatives of the ergot of rye (aside from the brief use of Methergin®)	Oral antidiabetic agents
Anti-cancer agents		Phenacetine
Atropine	Ethanol	Phenolphtaleine in chemical laxatives
Bromides	Iodine	
Chloramphenicol and derivatives	Indomethacin	Phenylbutazone
	Lithium	Radioactive elements
Chlortalidone	Meprobamate and derivatives	Reserpine
Cholecalciferol and dihychotachysterol at high doses		Sulphamides
	Morphinics	Synthetic antithyroid agents
Colchicine	Nicotine (heavy dose)	
Cyproterone	Novobiocin	Tetracyclines

Source : Francoual Ch et al. Pédiatrie en maternité. Paris, Flammarion, 1989, 478 p.

When the HIV is present in a lactating mother, the decision as to the type of diet should be based on the risks run by the infant. Bottle-feeding may be recommended if the family's socioeconomic level and home sanitation are satisfactory.

The child is ill

Breast milk is particularly important for ailing children, and this is not the right time for weaning. If hospitalization is required, the mother should accompany her child and be allowed to stay with him/her. If the child is unable to suckle, the mother may either express the milk herself, by hand, or use a milking machine, which is much more painful and traumatic.

In case of diarrhoea, breast-feeding should definitely not be interrupted. All diarrhoea treatment programmes presently prescribe the continuation of breast-feeding.

If the infant has a cold, with a stuffed nose, the mother should be taught to clean the nostrils by introducing a clean, twisted cloth, using a twirling motion.

Premature and small-for-date babies

Babies are able to suckle from the gestational age of 34 weeks on. A 1,800 g baby clearly does not have the strength to feed completely, however, and a 1,500 g baby cannot suckle at all. The mother must then be shown how to remove the milk from her breasts. She must extract the milk before each of the child's feeds, or about eight times a day. It should be remembered that if the number of extractions is too small, milk production will decline. When a baby is born before the full term, the mother's milk is richer in proteins than is mature milk : this is another example of the excellent adaptation of lactation to the different circumstances of the baby's life.

Prematures and small-for-date babies must be fed using a cup : it is neither necessary nor advisable to use a bottle or a nipple. Even if the child is unable to suckle, he/she should be placed on the mother's breasts so as to stimulate the milk production reflex, and to accustom it to gradually begin to suckle.

Both prematures and small-for-dates are highly sensitive to cold, and burn most of their energy to maintain their temperature stable, to the detriment of their growth. Pressing them to their mother's breast seems to be the best solution both with respect to milk production and to psychological contact and heat production. This is the "kangaroo mother" programme, first developed and tested in Colombia, and now implemented in many countries, including Great Britain and Holland. This is a great modern non-technological advance in dealing with the problems of prematures.

On the first day of life, a low-weight infant should be given 60 millilitres of milk per kilo of body weight, and a meal every 3 hours. This figure rises to 80 ml on the second day and on subsequent days until the 8th day, after which a 20 ml increment per day and per kilo is introduced. When the figure of 200 ml per kilo and per day is reached, it is maintained until the baby weighs 1,800 g, grows steadily and experiences no major difficulty in suckling at the breast. These amounts should be viewed as guidelines, and should definitely not be taken literally.

The main difficulty resides in teaching mothers to express their milk by hand. This technique can be learned, and mothers should receive training during antenatal consultations. No special material is required : the container used must be very clean, that is, washed in soap and water, sun-dried and rinsed in boiling water which is removed only at the last minute. The milk is extracted after washing of the hands. The thumb and forefinger are placed on the areola, above and below the nipple, and an outward pressure is exerted. The areola is then pushed back from the nipple, and this pressure is passed on to the lactiferous ducts, but the nipple itself is never pressed. Often the milk only comes out after several repetitions, unless the breasts are very full. The sides of the areola should also be pressed.

Breast-feeding and subsequent pregnancy

When a mother begins another pregnancy while lactating, there is no medical contraindication to the pursuit of breast-feeding, but most women discontinue it, alleging dangers for the child, the foetus or themselves.

It is a fact that most research has dealt with pregnancy and lactation as two distinct physiological occurrences. This is a scientifically normal attitude, since these two states produce antagonistic hormonal effects, and yet they may occur simultaneously. Lactation does afford protection against conception for some time, but ovulation may resume when mothers begin to introduce other food and to decrease the number of feeds, and occasionally this happens before any menstruation. This risk, which is greater in some parts of the world, makes greater energy and nutritional demands on the mother : lactation, pregnancy and a short interbirth interval reduce the mother's ability to recover, and increase the risk of exhausting her reserves.

When formulating policies, three practical recommendations are necessary. First, research in this area should be intensified, next, every attempt should be made to space births so that conception occurs at least 6 months after weaning of the previous child - that is, when he/she is aged about 12-15 months. Last, if the mother becomes pregnant again while nursing, an effort should be made to convince her to continue breast-feeding and to eat high-energy food complements. It is essential to persuade mothers that weaning is not urgent here : when a mother becomes aware of her pregnancy, it has already been under way for several weeks. She may therefore take another few weeks to wean her child gradually, and accustom him/her to the change of diet.

If the mother has twins

Mothers usually have enough milk for two babies. They do require support in performing all of the tasks that befall them, however, since they are often overburdened, and they need a rich diet. Some mothers feed both twins at once, others one after the other, some alternate breasts, others do not. In some cultures mothers tend to favour the child that grows and develops best, and workers should look out for this.

ARTIFICIAL FEEDING

This will be discussed briefly, since it is discussed in most books, and often at length. We will outline what we view as the main points, however.

When complementary feeding is implemented, either because of difficult living conditions, because the mother goes back to work early or out of deliberate choice, it is important to continue breast-feeding as long as possible, and to provide a complement after nursing : when possible, the child should be put to the breast at regular intervals, at least for a few minutes, after which artificial feeding may be offered.

Milks and infant formulas

If the newborn is not breast-fed, the question of what milk to give then arises. Artificial feeding uses the milk of an animal, usually the cow. It may be given whole, or following industrial processing of various sorts : the milk may be more or less skimmed, condensed, sweetened or not, or powdered. There are also infant formulas which may or not be humanized, and dietetic modified milk-containing infant foods. French law has formulated precise, strict recommendations for the preparation of dietetic modified milk foods prepared from cow's milk : they define the acceptable amounts of protein (15 to 18 g/litre), lipids (partial replacement by vegetable oils) and carbohydrates (mostly lactose). Cow's milk is greatly demineralized, and vitamins, and often iron, are added.

Powdered milks are produced by condensing, followed by drying. There are semi-skimmed milks for infants under age 5 months ; they are infrequently used. Condensed milks are obtained by vacuum concentration. They may be sweetened by the addition of sterile saccharose syrup, but this throws the milk composition off balance. Sweetened condensed milks are definitely not the most appropriate.

Despite all of manufacturers' efforts, these infant foods do not possess the qualities of human breast milk : they lack the "living" elements of breast milk which make a dynamic contribution to immunity and contribute to its perfect adaptation to the nutritional needs and physiological capabilities of human babies. Furthermore, iron supplementation is not the equivalent of breast milk iron, which has a better bioavailability.

Their cost

These shortcomings are compounded by the cost of these products, which are often too expensive for low income families. In addition to the cost of the milk, there is the cost of utensils such as bottles and nipples, if they must, unfortunately, be used, and the risk of infection, and of diarrhoeal disease in particular. Toward 1980, studies by the FAO in the Ivory Coast and Ghana showed that the time and money economized by families practicing breast-feeding represented 600 to 700 dollars for a child who suckles for 2 years, not to mention the advantages resulting from the decreased frequency of bouts of diarrhoea.

How to choose

But what milk should be used? This depends of course on what is available locally. If the infant is not given any breast milk at all, the use of an appropriate industrially processed milk is preferable. If the latter is not available or is too costly, cow's milk, powdered milk, yoghurt or milk curd may be given. Sweetened condensed milk should be avoided, although it is often available : the protein/energy ratio is too low, it is rich in saccharose and mothers tend to use it improperly. In addition, once the tin is opened, it does not keep well, especially in poor homes where there is often no refrigerator, and in hot, humid climates.

Fresh milk such as cow's milk should be diluted to a third for infants under age three months, and should be sweetened, but not in excess of 5 g per 100 ml (5 grammes = 1 lump of sugar). It should be boiled, while stirring when possible : this makes it easier to digest and destroys germs.

If whole, powdered milk is used, it should be prepared as follows : 6 parts whole milk, 2 parts sugar, 1 part oil are mixed with 7 parts of water. This provides a food with the same number of calories.

In those communities where yoghurt and milk curd are commonly eaten, it is preferable to use these foods for infant feeding : first, families know how to use them, secondly, pathogenic germs develop less well in them than in other preparations, and last, they keep better. These products are easier to digest and more easily assimilated by infants.

When skimmed, powdered milk is the only possibility, it should be remembered that this product is too poor in energy and in vitamin A to cover the child's needs. The addition of vegetable oil is required, and mothers should be convinced that this does not cause indigestion or diarrhoea. 3 parts skimmed milk are mixed with one part oil, then one part sugar. When mixed with 7 parts water, this food provides 60 kcal per 100 ml.

At-term infants with a birth weight around 3 kg should take an average of 6 to 8 meals a day at first. Low-birth-weight babies often need from 9 to 11 meals. It is preferable to give smaller amounts and to increase the number of feeds.

Spoon-feeding

Once a milk has been chosen, there is the question of what feeding technique to use. Every attempt should be made to avoid using a bottle, and to prefer a cup and spoon. Bottles and nipples are not easy to clean properly, and even when boiling is materially feasible, it is not sufficient, bacteriologically speaking. Furthermore, mothers tend to mix leftovers from the last meal with the new preparation. It is preferable, then, to use a traditional dish and a spoon, which are easily washed : soap, water and proper rinsing ensure the best possible enforcement of the rules of cleanliness. Plastic bottles are even more bacteriologically hazardous.

It is rather difficult to spoon-feed infants at the start, since they show reflex refusal, as mentioned above. When a spoon is put to their mouth, they tend to push it away with their tongue and to spill

part of the milk. After a few days, this reflex dwindles, however, and the child becomes accustomed to the spoon ; it is important then not to be discouraged.

Educating mothers

The education of the person taking care of the infant should be carefully prepared. The different motions should be practiced repeatedly in the presence of a competent individual, and if possible at home - that is, under the same conditions as will be encountered daily. These include preparation and washing of utensils, number of measures to be used, dilution, clearing up, storage of the milk, etc. A mark should be made on the container to show how much water it should contain. The child should be seen regularly, and relatively frequently at first, to make sure that growth and the development of skills is progressing normally. Breast-fed infants are able to regulate the amount of milk ingurgitated at each feed, depending on their appetite, and the composition of the milk is not the same at the beginning and at the end of a feed. These are perfections which cannot be achieved with artificial feeding, and women who choose this type of diet for the first time should therefore be given close attention. One primordial attitude must be adopted, and cannot be over-emphasized : mothers must be in a position to decide how their child will be fed, on the basis of as much knowledge as possible about the advantages, constraints and disadvantages of the different possibilities, and on the basis of the precept that the child must be given the best. A free choice is a wonderful privilege. The times when the mother feeds her baby should be moments of exchange, dialogue, stimulation, affection and warmth, and should take place in a peaceful, happy atmosphere if they are to achieve their utmost efficacy. It is out of the question to make mothers feel guilty, or to force those who hesitate into adopting any one particular type of diet, when they are opposed to it, deep down. This rapidly ends in failure.

On the basis of these tenets, very underprivileged families practically do not have a choice between breast-feeding and artificial feeding : indeed artificial feeding using a bottle is both costly and, for socioeconomic reasons, nutritionally poor and highly conducive to infection.

It is better to give a bottle with love than to nurse reluctantly and out of a feeling of duty.

WEANING AND DIVERSIFICATION FOOD

DIET AND CHILD DEVELOPMENT

When the child is 4 to 6 months old, breast milk alone no longer suffices, quantitatively, to cover nutritional needs (cf. table 4 and figure 11), since from then on rapid height and weight growth and increasing physical activity cause these needs to increase. During the first months, babies gain 1 gramme an hour ; from birth to age one year, their weight is multiplied by 3, approximately, and their height gains over 20 centimetres. Furthermore, the number of feeds decreases when the mother resumes her work outside the home or her participation in the family's farming activities.

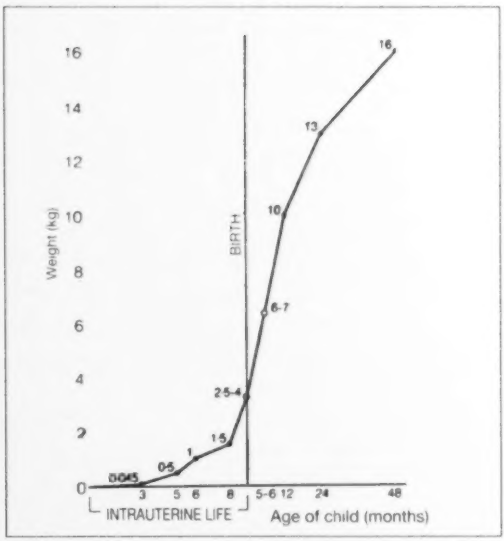

Figure 11 : Child growth up to age four years.

Research on energy requirements per kilogram of body weight show a decline between the 3rd and 6th months, followed by a levelling off until the 9th or 10th month, and then another rise. The lower requirements between the 3rd and 9th month clearly correspond to a period during which the extremely rapid growth characteristic of the first 3 months of life slows down but is not yet replaced by intense physical activity (cf. table 5). The figures of 99, 95 and 101 kilocalories per kilogram of body weight and per day may not seem very different, when expressed per kilo, but it should be remembered that the child's overall weight rises enormously during this period. It should be clear that these figures actually are on the rise since they are linked with the child's weight.

The subsiding of growth towards age 4 or 5-6 months is more evident in exclusively breast-fed infants than in those

Table 4

Ponderostatural growth (means)

Age	Birth	5-6 months	12 months
Weight (kg)	2,500 - 4,000	6 to 8	9 to11
Height (cm)	49 - 50	60	72 - 76

Table 5

Energy requirements

Months	Cal/kg/24 h
0-3	116
3-6	99
6-9	95
9-12	101

Source : WHO. Energy and protein requirements. Geneva, WHO, Technical report series. 1990 ; 724.

fed any other diet : the former give the impression that they are no longer following their earlier pattern. Some studies have dealt with children's growth in accordance with the type of feeding (breast milk or bottle feeding) (cf. figure 12).

The growth curve of breast-fed infants seems to be slightly lower than the others, but these studies cover small numbers of children, over a short period, and are insufficiently informed of their socio-economic and health status. Furthermore, greater weight gain is not a sign of good health, since beyond a certain point it may result in increased risks in the more or less long term. This slight divergence of the weight curve should not be automatically interpreted as a growth retardation and lead to diversification of the diet. It has been clearly demonstrated that healthy babies, breast-fed frequently and on request have a steadily, rapidly rising weight curve (and sometimes even more rapid than that of bottle-fed babies) until age 3 months. The pace then slows down, but as a rule they do still double their birth weight at 5-6 months. Breast-fed infants seem to be better apt to adjust their food intake to their needs.

Another point to be kept in mind is the latency period between insufficient dietary intake and its effect on measurable data involved in growth, especially height. The difficulty resides in teaching health workers not to confuse a normal physiological slowing of growth with a pathological retard caused by infections, diarrhoea, insufficient nutritional intakes or the mother's insufficient milk production owing to a highly precarious nutritional status : such confusion would result in the too early introduction of complementary foods, and thus foster a lowered milk production.

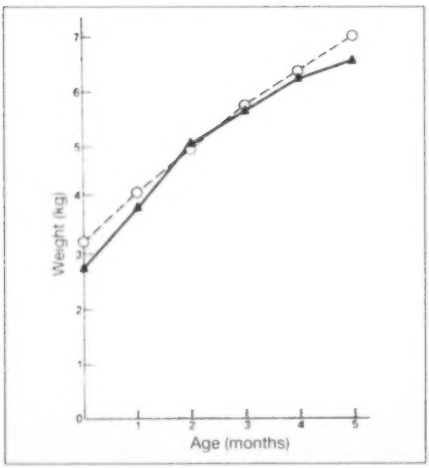

Figure 12 : Growth curves of exclusively breast-fed Myanmar infants (▲-▲) (n=17) compared to National Center for Health Statistics (NCHS) 50th centile (o-o) up to age 5 months (1).

(1) NAING K.M., CO T.T. Growth and milk intake of exclusively breast-fed Myanmar infants. European Journal of Clinical Nutrition. 45, n°4, 1991, pp.203-207.

Toward age 4-6 months, children should gradually be given a more varied, complemented diet : other foods, appropriately chosen in accordance with the child's needs and digestive capacity, but also with local food resources, should be added. It is important that families not be dependent on infant formulas, which may not be available because of unreliable shipping or their own fluctuating income, which may prevent the regular purchasing of overly dear food at some times of the month or year.

Toward the 6th month of life, the period known as the weaning period begins : mothers continue to breast-feed, but complete this with porridges made essentially of the food staple eaten by the family daily, or of manufactured infant formulas. The word "weaning" designates the time when the mother completely ceases to nurse her child. This is a real separation. This phase of life also corresponds to the beginning of a deep-seated change in the mother-child

relationship : the emotional ties which they have developed during the intrauterine period and after birth are transformed, the child must become accustomed to this and make his/her first steps towards socialization.

The weaning period

Weaning is a difficult time. How can the mother choose the best time to begin completing suckling? When introduced too soon, complementation considerably increases the risk of infections, and especially of diarrhoea, and may contribute to reduced milk production through less frequent feeds and the mother's premature resumption of ovulation. Attention, when food other than milk is given at a very early age, involuntary premature weaning may occur. When complementing is begun too late, there is a risk of hindering the child's development, and laying the way for chronic malnutrition. Once a solution has been chosen, physicians and health workers must analyse the situation, taking the different factors into consideration : these include children's growth, feeds, mothers' work, food and/or financial resources, behaviour and motivations, but also the degree of cleanliness of the household. On the basis of this overall diagnosis, counselling will be adapted to each mother-child situation.

There is no doubt that the mother's behaviour and beliefs play an essential role in the decision. She is usually influenced by those around her and by her household situation. After 2-3 months of nursing, many mothers express a degree of fatigue or even of impatience, because of their work load : some regard the moments spent at nursing as a waste of time, they feel inactive, and do not perceive the other, hardly measurable advantages.

When to start complementary feeding

Once again, we must repeat : there are no international rules as to when food other than milk should be introduced ; at most, there may be recommendations. Toward the age of 4-6 months, a complement should be given. It is clear that mothers who work, who leave home very early in the morning and return late in the day cannot be given the same advice as those who are in a position to nurse several times in the course of the day. Be this as it may, if a child is given both the breast and a complement during a same meal, the breast should always be given first, so that the hungry child will suck sufficiently energetically and thus empty the breast. Only after this should he/she be spoon-fed some porridge.

Diversification and dietary habits

What is the situation here? There has been a long tradition of describing typical situations, such as : children are breast-fed for too long in rural areas, and complements are introduced too late, while urban dwellers wean their children too soon ; the actual facts are more complex and subtle.

Breast-feeding and working mothers

In many rural areas, breast-feeding is often continued for 15 or 24-30 months. This is an interesting piece of information, but it is insufficient : we must know when other food is given, what it contains, how it is prepared and how often it is given. In some regions, farming is the woman's work, and fields are far from the village : small children are then left at home, to be watched by

older children or by the elderly. They are fed porridges, the amounts, quality and cleanliness of which are more or less appropriate, at a very early age. In rural parts of the Congo, for instance, nearly 84 % of 4 month-olds have already been given porridge. In this same country, 70 % of 9 month-old children no longer eat porridge, but are already being fed out of the family pot, with the ensuing risks for their digestive system, but also with respect to quantity and quality. They are not the first served, nor the fastest eaters !

In some rural areas, children follow their mothers to the fields. Here, other disadvantages have been documented (dehydration, diarrhoea, etc.). For this reason, certain village communities (such as Casamance, in Senegal) have set up day-care centres of sorts, where children are cared for by some adults from the community.

In poor urban settings, the situation is different. Breast-feeding is less frequent, and when practiced it is stopped early and replaced by a diet that is often quite random and inappropriate. A number of experiments aimed at promoting breast-feeding have been attempted, including the development of nurseries on work sites, in factories, hospitals, etc. Women are allowed to take 1 hour (or more) a day of their working time to nurse their baby. Results do not seem to have lived up to expectations : weaning still occurs rapidly, because of distance, relations with co-workers, anxiety, etc. The difficulties are even greater in the case of adolescents who are still attending school and are already mothers.

When mothers begin another pregnancy, they often stop nursing. There do not seem to be any medical reasons for this ; rather, it is a cultural problem. This is evidenced by remarks such as "the milk is bad, it gives diarrhoea, it is poison, etc.". There is no scientific proof of this.

Diagnosing the situation

There are some tentative responses to the question of the period during which mothers should introduce food complements, while continuing breast-feeding, but none of the easy-to-follow solutions is satisfactory. Health workers can do no more than inform and guide in decision-making, which is always the mother's prerogative. First of all, the prevailing living conditions must be analysed with those concerned, and the collective situation thus diagnosed, after which the picture may be refined for the different cases that arise, so that the solutions proposed will be not only scientifically solid, but also appropriate for each case and for the local situation at a given time.

The diagnostic approach to this weaning period is necessarily longitudinal, so as to view the overall evolution. It may concentrate on the following :

- determine the actual duration of exclusive breast-feeding in the different social strata and the average age at which other food is given ;

- determine the nature of the food composing the first porridges, including fluctuations caused by farming seasons or by varying monetary income in households ;

- identify types of preparation and storage of these porridges, but also how children are fed (frequency, quantity, quality and circumstances, spoon, bowl, ...) ;

- analyse the growth patterns of children in the geographic area, considering their representativity, their socioeconomic background, type of feeding (exclusive breast-feeding or mixed feeding), so as to detect the period during which malnutrition tends to occur, evidenced by a faltering weight curve. This involves increasing the number of weighings and measurements of children during the period around weaning time, so as to be able to provide dietary counselling at the right time.

For too many years, the fact that breast milk may play a major role during the weaning period was underestimated : scientific research and nutrition-related policies did not view breast milk as an essential part of the diet of children over six months old. All food education programmes must emphasize complementary foods, but also the continuation of breast-feeding.

COMPLEMENTARY FOOD

The first items used to supplement breast milk are the energy-rich food staples eaten by the local population ; they take the form of porridge, thinned at first and gradually thickened. These complementary foods are usually cereals (wheat, maize, rice, etc.) or roots and tubers (yams, manioc, taro, etc.). Table 6 shows the energy and protein value of those foods commonly used in porridges, so that appropriate receipts may be developed. All figures refer to uncooked food.

Once again, at the risk of being repetitious : these data pertain to food that has not undergone any preparation. While 100 grammes of raw rice provide 350 kilocalories and 7 grammes of protein, 100 grammes of cooked rice only contain 130 kilocalories and 2.5 grammes of protein, since the grains absorb much water during cooking.

When a small child is given porridge, this should be viewed as a complement and not as a substitute for breast milk. Choice of a food complement should take several qualitative and quantitative factors into consideration. First, the child's age and weight indicate the theoretical margin of caloric needs. Height is also a worthwhile indicator, for the evaluation of the weight to height ratio : this measures the child's corpulence or, in other words, his/her body proportions.

Table 6
Composition of some staple foods

Foods	Kilocalories per 100 grammes	Grammes of protein per 100 g of food
Wheat	340	10
Maize	350	9
Rice	350	7
Millet	330	12
Manioc	330	1.1
Yam	110	2
Potato	80	2
Sweet potato, Taro	120	1.6
Banana	90	1.5
Plantain banana	110	< 1
Sugar	380	0
Groundnut butter	550	23
Soybeans	400	35
Oil	885	0
Beans, niebe, lentils, peas	340	21-23
Chicken	300	18
Fish	100	18

Porridge, a complement, not a substitute

Next, the approximate amount of breast milk ingurgitated by children in the particular geographic area should be considered, so that porridges may balance their daily diet and compensate for any deficits in intakes. Appropriate receipts for porridges may then be proposed. One main problem in this estimation is the small stomach capacity of children of this age, which limits how much they can eat at any one meal. The objective, then, is to achieve a satisfactory caloric concentration in a small volume of thin - but not liquid - porridge. Apparently, the less fluid the child consumes the more he/she will be inclined to suckle.

A number of studies have estimated the average amount of milk produced by adequately nourished mothers (middle class, Zaïre) at 640 ml/24 h when they are nursing infants under six months old, and 470 ml/24 h for 24 month-old children. The figures for underprivileged mothers are 550 ml/day at 6 months and 470 ml at 24 months, but with a great many feeds (10 to 14 per 24 hours, and more at night than during the day). In Bangladesh, 12 to 17 month-olds received 600 ml of milk/24 h, and in the Gambia, Whitehead has clearly shown that mothers with an uncertain diet produced 400 to 500 ml of milk for their 18 month-old children.

Amount of milk secreted

On the basis of Hofvander's figures (1983), 500 ml of breast milk may be said to contribute 31 % of the energy requirements and 38 % of the protein requirements of a 12-18 month-old child, considering that breast milk protein is a reference protein. If a child's growth is to remain at the 50th percentile of the reference curve commonly used at the international level (the NCHS curve), the daily amounts of milk required, according to Whitehead's calculations, are : 735 ml at 2 months, 790 ml at 3 months, 840 ml at 4 months, 905 ml at 5 months.

These findings may be used to calculate the approximate amounts of porridge required, depending on the ingredients used and the number of meals. The difficulty frequently resides in the fact that traditional foods are bulky and have a low energy density. Where breast milk provides 70 kcal/100 ml, traditional weaning porridges yield from about 50 to 70 kcal, and the situation is even worse for protein concentration, types of protein, etc.

A few examples will clarify these points.

Rodrigo, age 6 months, weighs about 7.5 kg. His energy requirements, then, are : 95 kcal x 7.5 = 665 kcal/24 h.

He receives an estimated 640 ml of breast milk daily, representing 440 kcal/24 h. A complement of about 225 kcal is therefore needed.

Let us take a cereal-based porridge, prepared in one of the following ways.

Receipt 1

Milled cereal grains : 15 g, or $\frac{350 \times 15}{100} = 52.5$ kcal

Amount of milk required to obtain 100 ml of porridge : about 70 ml, or 50 kcal.

This receipt provides 100 kcal for 100 ml of porridge. Rodrigo would have to eat about 200 ml of porridge to cover his energy requirements, the rest being provided by the breast milk. Sugar could be added, about 5 g (1 lump) or 19 kcal.

When there is no milk, other foods can be taken.

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Receipt 2

Milled cereal grains : 15 g, or 52.5 kcal

Groundnut butter : 5 g, or $\frac{550 \times 5}{100} = 28$ kcal

Oil : 2 g, or $\frac{885 \times 2}{100} = 18$ kcal

Or sugar : 4 g, or $\frac{380 \times 4}{100} = 15.2$ kcal

These ingredients are diluted and cooked in as little water as possible, to obtain the desired consistency. For Rodrigo's energy intake to be balanced, he would have to eat 250 to 300 ml of porridge. In all, he would ingurgitate a daily volume of 900 to 1,000 ml (640 ml of milk and 300 ml of porridge), which is feasible for him.

These two receipts are easy to use, since they result in a porridge containing an average of 100 kilocalories for 100 millilitres.

Mohamed is another example : he is 10 months old and weighs 10 kg. His energy requirements are somewhere around 1,000 kcal. Since breast milk (about 400 ml) gives him an average of 300 kcal, he must receive another 700 kcal in the form of porridge.

Here are a few receipts yielding 350 kcal per 100 ml in as concentrated a form as possible (cf. table 7).

If the family can afford it, mixes including cereals or roots plus animal products may be recommended, so as to cover protein requirements. If not, animal protein is replaced by legumes (soybeans, lentils, beans, peas, groundnuts, etc.), but this requires that certain cardinal rules be respected as to the child's age and the preparation. This will be discussed further down.

If mixes containing 350 kilocalories per 100 millilitres are to be obtained, 10 grammes of oil + 10 grammes of sugar (2 lumps), or 5 grammes of oil and 20 grammes of sugar must be added to each mix shown in table 7.

All of these mixes provide about 5 to 6 grammes of protein.

In this table, the upper figure corresponds to the amount of the staple (cereal or root/tuber), while the lower figure is for the complement.

When the child is a little older, mixes including legumes may be given. These must of course be properly cooked and prepared, and given gradually, so that the child will assimilate them properly (cf. table 8).

To obtain 350 kilocalories for 100 millilitres, 5 grammes of oil or 10 grammes of sugar must be added. This reduces bulk to a minimum, so that the food is adapted to the child's nutritional requirements and stomach capacity.

Table 7
Basic mixes

Staples (g) / Supplement (g)	Wheat	Rice	Sorghum Millet	Maize	Potato	Sweet potato	Yam	Taro	Banana	Plantain Banana	Cassava flour, gari
Egg	65 25	65 30	60 30	65 25	300 25	180 35	220 25	190 25	190 30	150 45	60 50
Dried skimmed milk	65 10	65 15	60 15	60 15	280 15	175 20	190 15	180 15	165 20	150 20	60 20
Dried whole milk	55 15	45 25	45 20	40 25	220 20	100 30	115 30	115 25	100 30	90 30	35 30
Fresh fish	70 30	70 30	70 25	70 20	310 25	210 35	240 35	220 40	210 40	180 45	75 50
Chick or lean meat	65 20	65 25	65 25	65 35	300 25	180 35	210 35	195 30	185 40	160 45	70 45
Soybeans	60 15	55 20	55 15	50 25	250 20	150 25	175 20	150 20	140 25	115 30	50 30

Source : CAMERON M., HOFVANDER Y. Manual on feeding infants and young children. United Nations, 1976.

Table 8
Basic mixes with legumes

Foods	Wheat	Rice	Sorghum Millet	Maize	Potato	Sweet potato	Yam	Taro	Banana	Plantain banana
Staples (g) / Legumes (g)	80 10	65 25	75 10	55 35	320 20	125 50	165 40	150 45	105 55	85 55

Source : CAMERON N., HOFVANDER Y. Op. cit.

MANAGEMENT

One of the main rules to be respected pertains to the age at which complementary foods are introduced : neither too soon (there is a risk of diarrhoea and of decreasing the amount of milk secreted) nor too late (risk of malnutrition). It is a fact that families in industrialized countries begin complementary feeding very early (towards age 1 month), using cereal-based foods and pureed fruit and vegetables. This tends to be less frequent today, since pediatricians have become aware of the risks.

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The risk of overeating

Some studies have shown a correlation between weight gain in early childhood and later overweight. At age one year, children fed breast milk substitutes have a higher weight gain than those that are breast-fed. It is clear that overnutrition is one of the greatest risks of bottle-feeding and of over-precocious complementary feeding. Unjustified maternal anxiety over her child's diet may result in overnourishment, especially in settings where a healthy baby is pictured as a chubby baby. This may lead to overweight, and also to detrimental eating habits. It is important to constantly keep in mind the immense ability of human beings to adapt, and this is what is at stake in the fact that breast-fed children manage the amounts of milk they take, in accordance with their own needs.

Food products known as staples - that is, what the family eats normally - are energy-rich, and are almost always carbohydrates. Cereals include maize in some parts of Central and South America, millet in Sahelian Africa and rice in Asia, while roots/tubers include yams and taro in Central Africa and manioc in some tropical areas. These staples alone do not constitute a balanced diet, and they should be eaten in combination with other foods.

Protein intakes

Most families are unable to include animal protein (eggs, milk, fish, lean meat) in their daily diet. The solution, then, is to resort to plant protein, especially that contained in legumes (beans, chickpeas, lentils, groundnuts, soybeans). The quality of these proteins is not as good, since they do not contain all of the essential amino acids which children are unable to produce and must therefore derive from their diet. The amino acid that is missing or only present in minute quantities is called the limiting factor, and it varies from one plant species to another. Cereals are usually poor in lysine, whereas legumes are poor in methionine. To compensate for this, combinations of foods are recommended, such as a cereal plus a legume within a same dish. This type of mixture improves the protein value of the dish : the body therefore benefits more from a meal composed of several categories of food than from a single-food dish.

The first porridges, then, are prepared using the staple food, ground into flour. Millet grains may be directly ground or roasted first in a relatively thick earthenware dish to avoid burning and partial destruction of its nutritive value by overheating. This traditional method, which makes the porridge more tasty and is greatly appreciated by children, has the added advantage of facilitating digestion.

Wheat is disadvised because of its gluten (protein fraction which infants cannot always digest). At first porridges should always be mixed with milk, ideally, but since it is rarely available another energy-rich product is used : first sugar, then oil.

Introducing complementary foods

New foods should be introduced one at a time, to make sure the child is able to digest them. For instance, to accustom the child to chewing and to eating new foods, he/she is given 1 to 2 teaspoons of cereal porridge (rice, millet or maize), or of mashed boiled or steamed tubers, or a bit of peeled, mashed fruit (banana). If the

child refuses, another attempt should be made later. A few days should be taken to allow the child to get used to it, with close observation by the mother, before trying another food. The amounts of the staple-food porridge are increased gradually, then other foods are introduced, within a period of about two weeks. The child's refusal should not be a cause of concern. It takes time to get used to new tastes and consistencies, and also to eating with a spoon, then from a bowl or cup.

Lipids

It should be remembered that for a 7 to 8 month-old child to be properly nourished, 25 to 30 % of the energy must be provided in the form of lipids, which have the advantage of being very energy-rich in a concentrated form. In some regions where little or no lipids are produced, children often are fed no fats, and this hinders their development. Some fatty acids such as linoleic acid are essential for growth, and must be eaten by children. Vegetable oils should be preferred, with special preference for groundnut oil towards 4-5 months. While palm oil is rich in vitamin A, it is difficult to digest. Cottonseed, maize or soy oil, or karity butter are also acceptable. Butter is not recommended.

Fats and oils also improve the taste and consistency of many foods. Porridges vary in consistency with their temperature and oil content. Since children find it difficult to swallow porridge which is thick, or even solid, at first, mothers tend to add water. Porridge thickens as it cools down. The addition of oil improves its energy value and the amount of water may be decreased. This way the child's porridge will have a satisfactory consistency.

Porridges should be prepared just before the meal, in a well-washed dish, sun-dried if possible. They should be thoroughly cooked, and the keeping of leftovers for the following meal is very strongly disadvised, because of the risk of germ proliferation, especially in hot climates.

The child is fed using a clean spoon. One daily porridge meal of about 150 to 200 ml is given at first, then two if breast milk is insufficient. If the child is given breast milk and porridge in the same meal, he/she should be put to the breast first and fed the porridge afterward. Toward 6-8 months, the number of porridge meals and the amount of food should be increased (to 200 - 250 ml), and at the same time, greater variety should be introduced, with legumes, animal protein, fruit, vegetables and green leaves. Legumes such as beans, lentils, peas and niebe require more preparation : they must be soaked first, to eliminate their cuticle, then cooked for several hours, until reduced to pulp. Children then have no difficulty digesting them. In some regions, legumes are ground and eaten in flour form.

The traditional porridge, especially if it is made of tubers, should be enriched, when possible, with animal protein - either meat (6 to 10 grammes) or dried fish (3 grammes) - if not with plant protein. Groundnuts should be eaten cooked, and the skin removed so as to reduce the risk of diarrhoea. Children usually like groundnut

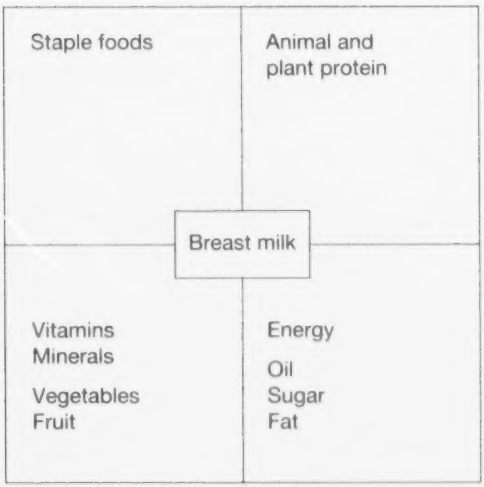
paste, a common food in Africa : following roasting and pounding, groundnuts may be given to 5-6 month-olds. In regions where soybeans are grown, their use is recommended.

Leaves, green or dried, are still eaten in Africa : the habit is being lost, and this is unfortunate, since spinach, manioc, baobab, amaranth and other leaves provide protein (4 to 7 %), minerals and vitamins.

Vegetables such as marrows, gumbo, carrots and tomatoes, as well as fruit, should be included in the child's diet. The latter are of course generally used for snacking between meals, and are not viewed as food. The usual behaviour of families with respect to the consumption of fruit and vegetables should be observed in general, and at different seasons, so as to take customs into account when orienting counselling.

Table 9

The food square



From 5-6 months on, the infant's diet should fit all five boxes.

There is another problem, that of receipts. It is important to avoid complicating mothers' work and increasing their work load.

The ingredients recommended for a porridge receipt should be easy to find (be wary of seasonal variations) and porridges should come from the family pot : at some point in its preparation, a portion is removed and given special treatment to become children's porridge. If the porridge is specially prepared for the child, it should be easy to make and quickly cooked, and above all, mothers should be given the proper weights and proportions, fol-

lowing conversion into the common household measures, such as spoonfuls, cups, calabashes, reclaimed boxes, etc.

During oral explanations and food education demonstrations, the amount recommended in a receipt should be clearly shown, using the utensil which will be used subsequently : a spoon should be full of flour, but not overflowing, a cup should be filled level. Emphasis should be placed on the uniform use of these "measures", especially in the case of spoons, which may vary in size. A check should be made later, to make sure the mothers use the measures properly at home.

Different foods vary in weight for a same volume : sugar weighs twice as much as most flours, for a same volume. Fresh beans are heavier than dried beans.

Table 10
Average weight of some foods, using different measures

Foods	Weight in g (level measure)		
	Teacup	Teaspoon	Soupspoon
Water	85	5	20
Flour (legumes)	50	2	12
Flour (cereal grain)	50		12
Maize (whole)	60		
Rice (whole)	70		30
Sugar	80	4	20

These are approximate figures. Each of these should be recalculated for the specific geographic area involved. To help mothers, who usually do not have scales, to calculate the amount of food their child needs, it is a good idea to measure the volume of the locally used utensils (glass, spoon, calabash, bowl, etc.). An average bowl contains 200 to 300 ml, a glass 200 ml, a large spoon 10 ml and a teaspoon 5 ml. These volumes should be checked systematically. Next, the different foods contained in these - cereal grain flours, bean flours, oil, sugar, etc. - should be weighed. Thus, a teaspoonful of powdered milk weighs 5 g, a bowl of cereal grain flour 170 g, a soupspoon of sugar 10 g.

In conclusion, it should be remembered that the recommended amount of each nutrient cannot always be given each day, at every meal. The coverage of nutritional needs should be achieved over a longer period, of about one week.

WEANING MIXES

For many years now, some countries have been developing weaning foods with the help of international organizations such as the FAO, FISE/UNICEF or WHO, to enable children to go through this period as well as possible. To mention just a few of these innumerable attempts : there is Superamine in Algeria, Incaparina in Latin America, and Vietnamese weaning food, but also, Ladylac (millet-

groundnuts) in Senegal, CSM (maize, soybeans and milk), AK 1,000 in Haïti (maize, sorghum, rice, beans), etc.

Weaning foods must be stable, inexpensive, acceptable, made from local products subjected to nutritional quality control, easy to store and use, purchasable by all income groups, readily available and not subject to shortages. When properly conceived, they provide the country's children with an appropriate food, adapted to their specific needs and are also valuable as a complement at other times of life (children over three, pregnant women, etc.).

Of the hundred-odd formulas tried, only a few were reasonably successful, for a number of reasons, including shortcomings with respect to : acceptance of the product by the population, a sufficiently large market, a satisfactory commercial network (transportation, storage, sales points), uninterrupted production, attractive, inexpensive packaging, adequate preservation, etc. Another problem arose : the composition of the food. In many mixes, an ingredient which is not produced by the country - often, milk - was included to achieve a balanced product. This makes the country dependent on other nations or organizations, and may further compound the already numerous difficulties.

Composition of various mixes

Superamine

Wheat flour	28 %	Chickpea flour	38 %
Lentil flour	18 %	Skimmed milk	10 %
Saccharose	5 %		

Added ingredients (vitamins A, D, B2, B6, PP, C and calcium carbonate) : 1 %. 100 g of the mix contain 414 calories, 20.5 g of protein, 4.5 g of lipids and 54 g of carbohydrates.

Incaparina

Maize flour	58 %	Cottonseed flour	38 %
Torula yeast	3 %	Calcium carbonate and vitamin A	1 %

Cottonseed flour has been eliminated for the moment, since production has dropped considerably. It is replaced by soybeans.

Weaning food (Hanoï)

Rice	70 %	Soybeans	20 %
Sugar	9.5 %	Other nutrients	0.5 %

100 g of this food yield 357 calories, 14.4 g of protein and 3.6 g of lipids.

Another mix containing skimmed milk was rejected, since the country produces very little milk. Given the insufficient fat content of the family diet, it must be said that this mix is rather poor in lipids.

Since large-scale projects for industrial-type manufacturing of weaning foods have repeatedly been found unsatisfactory, with

respect to both processing and marketing, there have been attempts at cottage-industry-type production at the village or province level, with small processing units using local produce and simple technology. In Benin, for instance, the Ouando horticultural and nutrition centre has developed a mix for three to six-month-olds, and another one for children beyond the age of six months. The former is made of maize, rice and sugar, the latter of maize, sorghum, beans, groundnuts and sugar. In Burundi, Musalac is a very popular mix. These attempts seem to be more adapted to local needs.

RESEARCH

One major difficulty which must be solved when introducing complementary foods is that of the energy density of porridges. Traditional porridges are bulky and low in energy, so that it is difficult to achieve a sufficient energy intake with a consistency acceptable to small children, and especially to infants and sick children, who prefer very fluid porridges. The nutritional value of these porridges is about one third that of industrial-type mixes. Now, children are incapable of eating large amounts at this age, especially if meals are far between (the mother is very busy) or in case of loss of appetite. To solve this problem, researchers have launched studies on food preparation techniques aimed at increasing nutritional value and reducing the risk of contamination. These techniques must be easy to teach, simple, related to local habits and acceptable in terms of preparation time and cost.

Energy density

Two procedures were selected, on the basis of an inventory of weaning practices in rural and urban settings and of the prevailing food-preparation techniques : these are sprouting and fermentation. The objective is the breakdown of the starch chains which constitute 70 to 95 % of flours, and thus limit their ability to absorb water. With these procedures, the dry food content of porridges, and consequently their nutrient concentration may be increased, while retaining satisfactory fluidity corresponding to children's needs. These porridges are nutritionally far more valuable, for a given volume.

Traditional porridges contain about 15 g/100 g of dry matter, irrespective of their ingredients (cereals or tubers), representing a density of about 60 kcal/100 ml, whereas more than 75 kcal/100 ml are needed. If only one or two porridge meals are given daily, the energy ration is insufficient as a complement for breast-feeding.

Practically speaking, it is easy to see that cereals absorb water during cooking, and may double or triple in volume. Roots and tubers, on the other hand, do not absorb much water and do not increase in volume following boiling or steaming.

It has been found that thick cereal porridges may be thinned by the addition of a small amount of amylase-rich ground sprouts. This is a common practice in Africa, for adult food, but is not applied to porridges made for children. And yet, when a small amount of sprouted tubers are added to a porridge made of roots and tubers, the resulting preparation contains 25 grammes of dry

Sprouting

matter for 100 millilitres, or about 100 kcal for 100 millilitres (research by ORSTOM). This type of technique has been widely popularized in Tanzania by the TFNI (Tanzania Food and Nutrition Institute).

Purchased enzymes (alpha-amylase) may also be used. The cost of the different techniques, and people's ability to use them should be analysed before recommending any one means of improving the energy density of porridges.

Fermentation

The other method involves fermentation of cereals, using lactic acid-producing bacteria. This is one of the oldest known techniques, since it dates back to antiquity. It seems to have two advantages : it increases the bioavailability of proteins, minerals and vitamins, and inhibits the proliferation of micro-organisms. The latter action enhances resistance to contamination, thus making storage of porridges easier.

These studies should be continued, both in research laboratories and within communities, with emphasis on the different products used in each country. The impact of such mixes on children's growth and activity and on the incidence of diarrhoeal diseases should be measured as well, and the effect of breast milk intake on the consumption of these high-energy-density porridges investigated.

In a seminar conducted in Kenya in 1987 (1), optimal conditions were defined as a reference for the preparation of weaning foods for small children. They are :

Definition of optimal weaning mixes

- foods should be rich in calories and nutritive elements, have high bioavailability and contain few antinutritive factors ;

- they should have a low thickness coefficient, so that a large amount may be eaten at a single meal, with the important resulting reduction of the number of meals required to satisfy the daily energy requirements of small children ;

- their preparation should be economical, with respect both to ingredients and to the fuel required for cooking ;

- they should make use of crops suitable to the local farming practices and climate, using appropriate technology such as village hullers, for the preparation of staple foods ;

- whenever possible, ingredients available year-round should be used : appropriate substitutes should be available in case of a temporary shortage of some ingredients ;

- they should be easy to prepare and convenient, require simple utensils and reduced cooking, preparation and eating time ;

(1) Pour améliorer l'alimentation des jeunes enfants en Afrique orientale et australe : une technologie à la portée des ménages. Nairobi : CRDI/FISE/ADIS, 12-16 October, 1987.

- safe storage of the finished product as well as of its ingredients should be feasible within homes ;

- they should be culturally acceptable and have a pleasant taste, appearance and texture, for both child and mother ;

- the preparation technique should be easy to teach and to understand, and ideally, should be based on familiar, traditional methods ;

- they should be thick enough to make bottle-feeding difficult or impossible.

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Appendix 1[1]

SAMPLE QUESTIONS FOR USE IN SURVEYS ON BREAST-FEEDING INDICATORS

Date of interview.....

For each child less than 24 months old ask the respondent :

1) Can you tell me how old this child is today?
(if possible, the exact date of birth)

2) Since this time yesterday, has (name) been breast-fed? YES NO

If yes, was this (name)'s main source of food? YES NO

3) Since this time yesterday, did (name) receive any of the following :

- vitamins, mineral supplements, medicine YES NO
- plain water YES NO
- sweetened or flavoured water YES NO
- fruit juice YES NO
- tea or infusion YES NO
- infant formula YES NO

Which one? .....

- tinned, powdered or fresh milk YES NO
- solid or semi-solid food YES NO
- oral rehydration salts (ORS) solution YES NO
- other (specify : .....) YES NO

4) Since this time yesterday, did (name) drink anything from a bottle with a nipple/teat? YES NO

If yes, please describe : .....

(1) WHO/CDD/SER/91.14

Appendix 2

TEN PREREQUISITES FOR SUCCESSFUL BREAST-FEEDING

Every establishment providing maternity hospital services and neonatal care should :

1. Adopt a breast-feeding policy, put it in writing and keep all health workers routinely informed of it.

2. Provide all health workers with the training necessary for the implementation of this policy.

3. Inform all pregnant women of the advantages of breast-feeding and of nursing.

4. Help mothers to begin nursing their baby within a half-hour of birth.

5. Show mothers how to practice breast-feeding and how to maintain lactation even if they are separated from their infant for several hours a day or during 2 to 3 days.

6. Not give neonates any food or drink other than breast milk, except for medical purposes.

7. Leave the child and mother together 24 hours a day.

8. Encourage self-regulated breast-feeding.

9. Not give breast-fed infants any artificial nipple or anything to suck on.

10. Support the development of clubs for the encouragement of breast-feeding, and send mothers to them as soon as they leave the hospital or clinic.

Appendix 3 [1]

SUMMARY OF THE INTERNATIONAL CODE

1. Breast milk substitutes, baby bottles and nipples should not be advertised.

2. No free distribution of samples to mothers.

3. No promotion of products within health agencies.

4. No "infant nurses" sent by manufacturers to advise mothers.

5. No gifts or free samples distributed to health workers.

6. No writings or pictures praising infant formulas, no pictures of infants on product labels.

7. The information given health professionals should be confined to scientific data and to facts.

8. All information on artificial feeding for infants, including on product labels, should contain an explanation of the dangers connected with artificial feeding.

9. Products which are inappropriate for infants, such as sweetened condensed milk, should not be advertised as infant foods.

10. Products should all be of the highest quality and the local climate as well as prevailing storage conditions should be taken into consideration when using them.

(1) Source : Conseil oecuménique des Eglises. Revue Cohtact n° 102, 1989, Geneva.

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FEEDING BABIES : FROM BREAST MILK TO FAMILY DISH

1992 - N° 202-203

Breast-feeding is not a new subject : articles abound on the epidemiology and advantages of breast-feeding for infants, as well as on its management.

As a complement to these, the present issue discusses the anatomy and physiology of lactation, its role in birth spacing and the influence of the mother's nutritional status on this feeding practice.

One chapter deals with complementary feeding during the weaning period, and includes several examples of porridges, but above all, the points to be respected in developing other receipts are emphasized, so that children's food may be adapted to local food resources as well as to their nutritional requirements.

In conclusion, the reader will find an overview of present research into the means of providing children with food containing a higher energy density.

With thanks to Micheline d'Agostino - ICC for the cover illustration

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